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ON THE COVER

FACED with the job of excavating a trench across the Genesee River at Rochester, N.Y., to carry high-tension electric lines, the contractor was uncertain how to proceed. There was not enough work involved to warrant bringing in heavy, costly equipment such as is commonly used for submarine drilling. A sales engineer supplied the answer by suggesting that he utilize a drill-rig attachment of the type often mounted on a tractor for the removal of rock in digging oil- and gas-line trenches and suspend it from a crane line. A small barge was procured, equipped with a crane and two portable air compressors, as shown on the cover. As an article in this issue (page 180) relates, the task was completed without a hitch.

●

IN THIS ISSUE

HEAT expanded perlite, an extremely lightweight natural aggregate for plaster and concrete, is so new to commerce that it wasn't even mentioned in the 1945 *Minerals Yearbook* issued by the U.S. Bureau of Mines. In 1946, national production amounted to 4.026 short tons and only three companies made shipments. In sharp contrast, there are now so many in the business that they have formed the Perlite Institute, which reports an output during the last three months of 1,110,250 bags of 4 cubic feet each, equivalent to about 22,000 tons. The story of perlite is told in our leading article.

●

THE salvage of any sunken vessel usually borders on the spectacular, and this was true in the case of the refloating of a suction dredge that went down in the Mississippi River at Alton, Ill. Page 177.

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THE agitation of milk in dairies to prevent cream separation has traditionally been done with mechanical stirrers, but it can be accomplished easier and at less cost with compressed air. This is an entirely sanitary procedure because compressors fitted with graphite piston rings are given no cylinder lubrication, and oil consequently cannot be carried along with the air. Other possible contaminants are filtered out. Advantages of air agitation are set forth in the article that starts on page 184.

●

THE elastic, untiring energy of compressed air has replaced human muscles in countless factory operations. It can do these diversified jobs not only quicker than men but also exactly the same every time. A typical example of air power's highly varied service is described in the article that starts on page 187.

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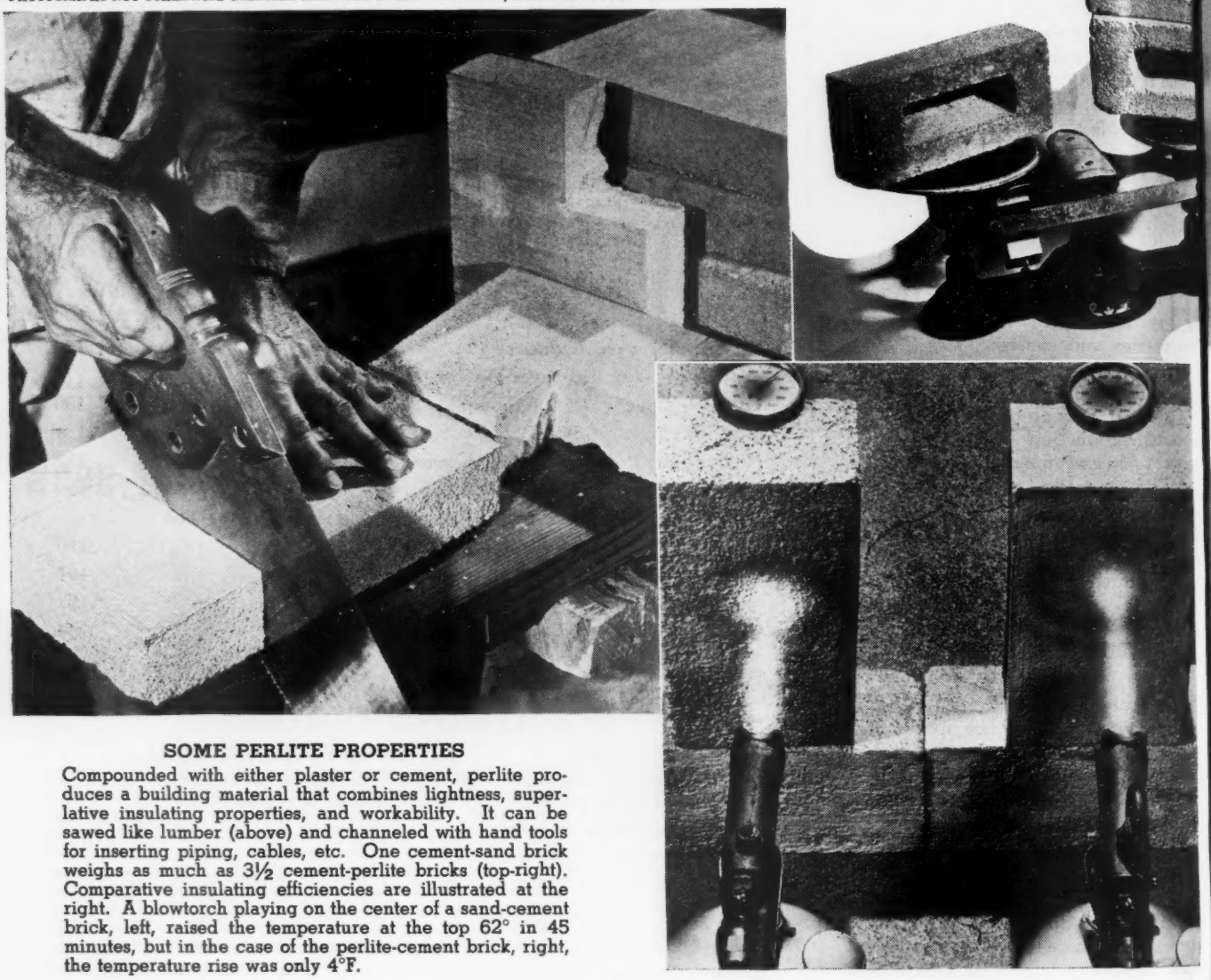
PERLITE

A New Contender for the Lightweight Aggregate Title

Fremont Kutnewsky

PHOTOGRAPHS NOT OTHERWISE CREDITED ARE FROM ALEXITE DIVISION, ALEXANDER FILM COMPANY



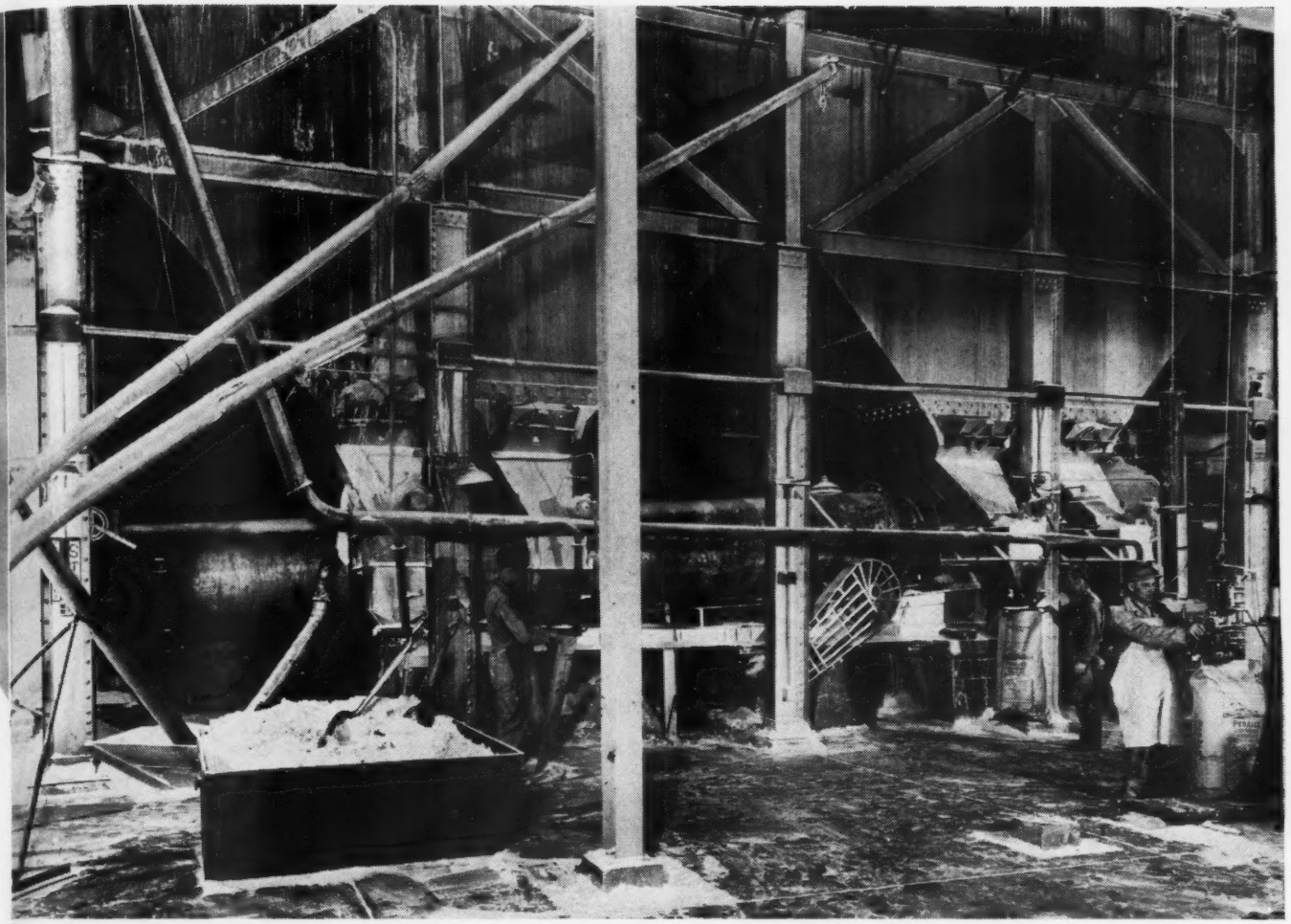
SOME PERLITE PROPERTIES

Compounded with either plaster or cement, perlite produces a building material that combines lightness, superlative insulating properties, and workability. It can be sawed like lumber (above) and channeled with hand tools for inserting piping, cables, etc. One cement-sand brick weighs as much as 3½ cement-perlite bricks (top-right). Comparative insulating efficiencies are illustrated at the right. A blowtorch playing on the center of a sand-cement brick, left, raised the temperature at the top 62° in 45 minutes, but in the case of the perlite-cement brick, right, the temperature rise was only 4°F.

LATEST advices on how to protect ourselves from an atomic bomb blast indicate that a rubber-walled building would provide maximum safety except from a direct hit. Such a structure would "roll with the punch." We can't expect to construct our houses of rubber, but the nearest practical substitute probably would be pumice or perlite concrete. Whether this is being taken into consideration, or whether other advantages are turning the scale, there is a tremendous and growing demand for these natural, lightweight aggregates for structural concrete and plaster, especially in the western states where pumice and perlite come from volcanic areas all ready with minimum processing for the trowel, the mold, the mixer, and the blowgun.

In the case of pumice, its recent popularity is a sort of renaissance. The Romans found it an excellent material for large edifices, especially for domed roofs. But perlite, first cousin to pumice, is something else again. Its characteristics and potentialities remained one of nature's best-kept secrets until around 1940 when the building trade was given a new material that can be tailored to the job with great variety and freedom. Since then the industry, like a kid with an erector toy, has been surprising and delighting itself with the wonderful things that can be achieved with perlite.

Perlite gets its name from its sheen, which is attributable to its concentric cellular formation. It is a siliceous volcanic glass that would have been pumice had it been exploded into the air. Lying deep down in the earth it contains dissolved (magmatic) water. Pumice, on the other hand, is puffed out like smoke. Its entrapped vapors expand and, for the most part, escape so that it comes down light and fluffy. Perlite is extruded in a stiffer condition from crevices in the side of a volcano, or from any area where molten material is escaping from below. One can imagine this hot stuff bubbling out of cracks in the thick rock-like mud,



PERLITE EXPANSION FURNACE

As it occurs in nature, perlite contains from 2 to 5 percent of moisture. When just enough heat is applied, the rock softens, the moisture is converted into steam and expands, creating myriads of bubbles that fluff up the perlite somewhat like beaten egg white. There are 65 expanding plants in 35 states, thus making it possible to ship the less-bulky raw material before exfoliation to the area where it is to be used. The rotary furnace shown here is 40 feet long and 3 feet in diameter. Perlite is fed into it at the right end at the rate of a ton an hour. The expanded aggregate discharged at the left end is elevated and, after removal of dust, is air-graded into different sizes and stored in four bins until sacked. Capacity production of the unit is 1600 cubic feet in eight hours.

emitting steam as it gets rid of some of its water content. But, unlike pumice, it retains from 2 to 5 percent of the moisture with which it was mixed as the earth gradually congealed from its original gaseous state.

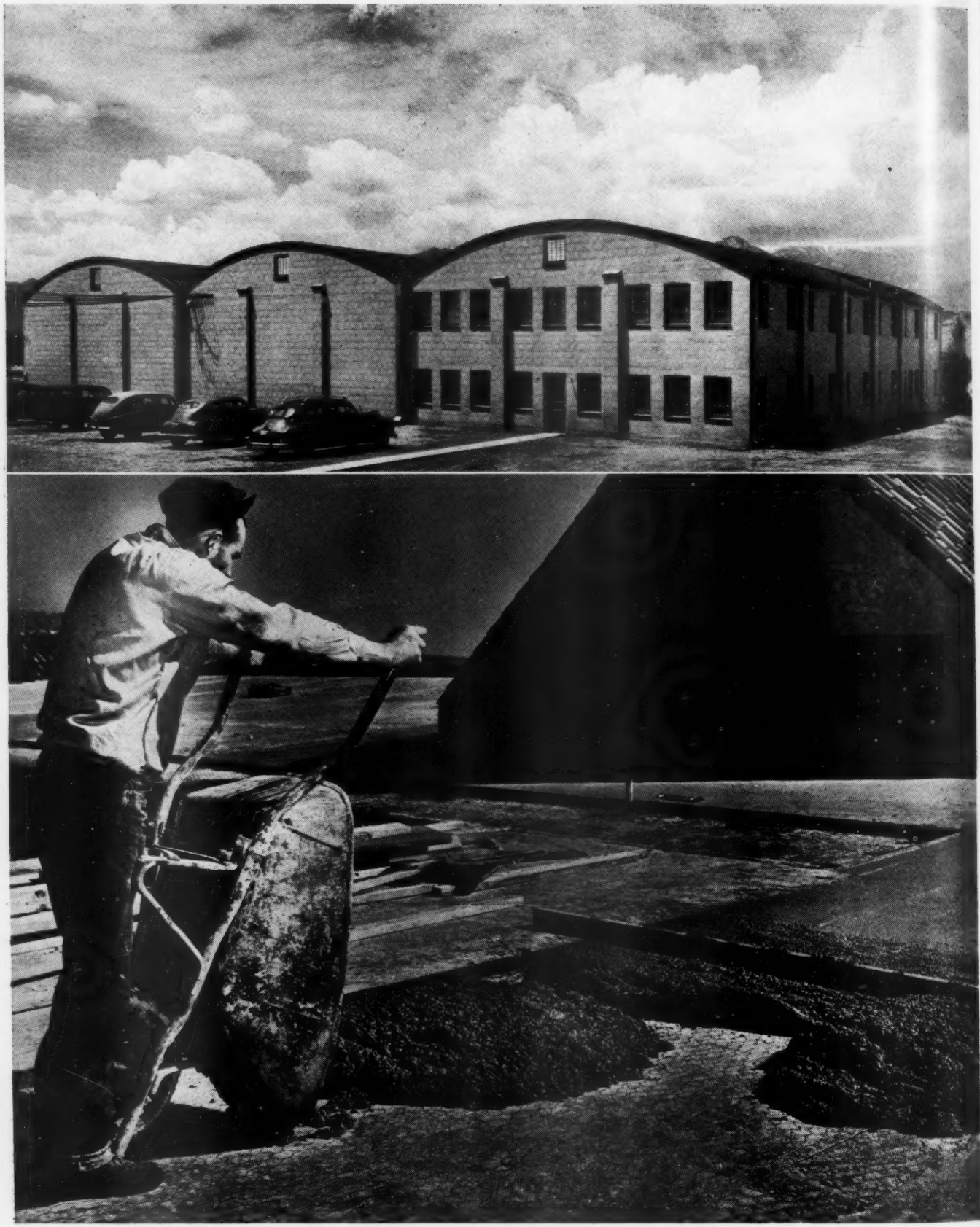
You can bake the moisture out of perlite. Even when it is crushed, this apparently dry rock releases moisture. (Here is a hint as to the newest Rube Goldberg method of getting a water well out of solid rock by geophysical methods, as they are beginning to do in New Mexico. But that's another story.) The trick of making this aggregate for plaster and for structural members is to apply just enough heat just fast and long enough to soften the rock. The trapped vapors expand, but only partially. What you have then is a mass of tiny glass bubbles somewhat resembling beaten egg white except that it is rigid. It might be called a "hard-rock" counterpart of fiber glass. Pumice, on the contrary, has to be taken as it comes already expanded, or mostly so, by nature.

A cake of expanded perlite will float on water. No one knows the infinite variety of structures that may be formed by different heat treatments, commonly called "popping." Today there are 65 expanding plants in 35 states, and as a replacement for sand in plaster the material is going great guns the country over. Perlite plaster got national publicity as a novelty when it was used in remodeling the U.S. Senate chamber at Washington, D.C. Senator Anderson (New Mexico) reported: "We all lifted handfuls of the light, fluffy plaster aggregate and tossed them in the air to see how fluffy they were and how much of the dead weight they would take out of building."

Deposits of perlite rock are found in seven western states lying in the volcanic belt of the Rocky Mountains. In New Mexico and Colorado they roughly follow the Rio Grande Valley, north and south. Dr. Eugene Callaghan, professor of economic geology at the New Mexico Institute of Mining and Technology, says that there is a "greater proportion of rhyolitic rocks in New Mexico than in any other state," and he expects the same is true of perlite which, like pumice, is rhyolitic. In rock form it is rolling out of New Mexico at the rate of 150 to 250 carloads a month. For the year 1950, the country's total output of crude perlite was approximately 80,000 tons, which yielded about 15,000,000 cubic feet of expanded products.

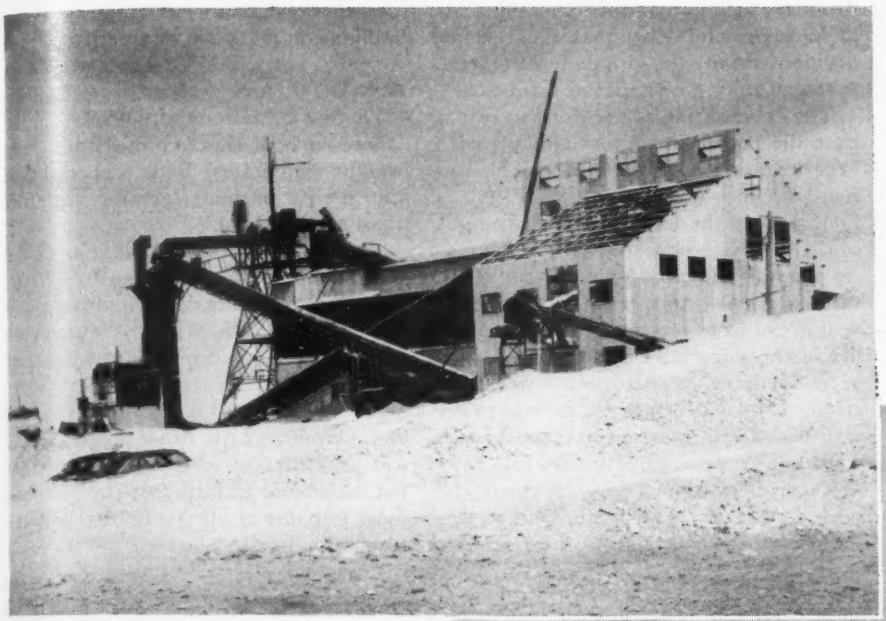
One reason why perlite is an ideal aggregate is that builders can buy it as rock and ship it at minimum freight rates. When a carload is received, it can be put through a furnace and will yield from eight to fifteen carloads of bubble-filled, glassy granules of any desired size and strength. As the U.S. Bureau of Mines declared in a bulletin in 1946, "The attractiveness of perlite comes from the degree of control of porosity and strength."

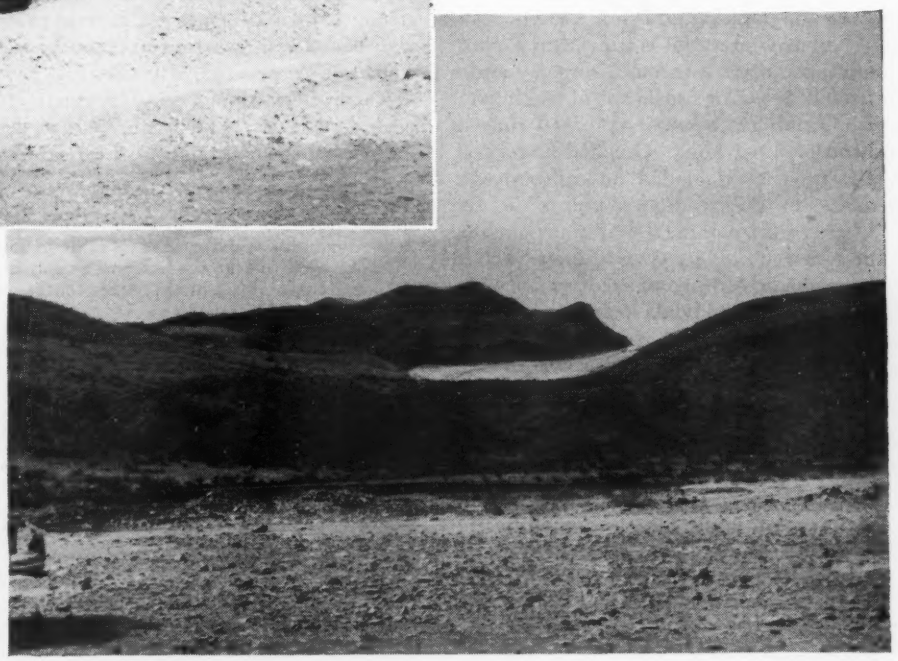
Made into plaster, the material weighs only a third as much as ordinary sand plaster. Put on a wall ½ inch thick in an



EXAMPLES OF CONSTRUCTION

The Alexander Film Company, which makes advertising shorts shown in neighborhood and small-city movie houses, also has a division (Alexite Engineering) that produces perlite, which it sells under the trade name Peralex. It has used this material liberally in its own 100x150-foot studio (top) at Colorado Springs, Colo., where five camera crews shoot 3000 of the capsule commercials a year. The steel-framed building has 6-inch walls of Peralex-cement brick that furnish as much insulation, it is claimed, as 6 feet of ordinary sand-gravel-cement concrete construction. The roof and floor also contain Peralex, as does the plaster on the office walls. The exterior walls were weather-proofed with a brush-on stucco having a Peralex base. The lower picture shows a roof deck being poured with a wet mix of ten parts Peralex and one part cement. A 3-inch layer weighs only 10 pounds per square foot. It is said that a bonfire on such a covering will burn out harmlessly without scorching a flammable undersurface.





MINING IN NEW MEXICO

Perlite occurs in seven Rocky Mountain states and is probably most abundant in New Mexico, where entire hills are composed of it. Where the area in the picture below is light, mining operations have reduced the surface level approximately 70 feet. The other view shows the crushing, sizing, and drying plant of the Great Lakes Carbon Corporation, the state's largest perlite producer.

PHOTOS BY AUTHOR

average room the saving in dead load is about one ton! It is a natural for ceilings —goes on like frosting on a cake and is easy on the workman who applies it. Furthermore, as the mix requires less water, it dries fast, which fits in with modern rapid-fire construction. With sand plaster you have a day or so of dampness in rooms; with perlite plaster you can move in the same day it's put on. It works fine in a cement spray gun.

Another advantage from the standpoint of application is that one coat, instead of two or three in succession, completes the job. Once on a wall, you have about twenty times the insulation that you get with a sand-and-gravel aggregate, while structural parts—floors and walls—containing perlite have ten times the insulating properties of concrete mixed with sand and gravel. For the latter purpose the material is processed for greater bulk density and crushing strength than for plaster.

In Phoenix, Ariz., where insulation against the sun's rays is of primary importance, a contractor precast the parts of a $1,500,000 bakery and then erected the whole thing in 53 days. He used large 4-inch-thick slabs composed of 2 inches of perlite mix for the interior and 2 inches of solid cement for the exterior. Without air-cooling, the working areas of that bakery are tolerable in 114°F. summer heat. Perlite-concrete walls need no plastering, the surface may be troweled smooth or rough, in panels or in patterns.

The new Mirror (newspaper) Building in Los Angeles, Calif., has walls and stuccowork of perlite, a type of construction that is lightning- and fireproof, as earthquakeproof as it can possibly be made, and that doesn't require painting. Monolithic roof decks covering acres have been poured of perlite concrete and weigh only about 10 pounds per square foot. The reduction in steel requirements by use of this lightweight material is enormous. Decks of this kind can be placed on new or existing roofs and give excellent protection from the sun's rays.

Perlite masonry can be sawed like lumber, channeled with ordinary hand tools, and things can be nailed to it. This revolutionary material is being used to make reinforced load-bearing members, especially where fire protection and insulation are needed, at a 50 percent saving in weight as well as cuts in transportation and installation costs. In the form of plaster or concrete, perlite is the ideal fireproofing for wood or steel in buildings. So little goes so far, and it's so light that columns and other supporting members can be considerably reduced in size, walls made thinner, and rental space proportionately increased. The saving in weight is still greater if the material is used as a topping for structural subfloors and as an insulation for roofs. In the case of walls, perlite offers a bonus—high sound absorption, which is highly desirable in modern crowded office buildings, hotels, etc.

Perlite shares with pumice the elements that create a spongy concrete that has great resistance to distortion—that absorbs the shock of an explosive force and withstands shaking, such as is experienced in an earthquake. Hence it was used during World War II to pour cushion layers in concrete fortifications and thick roofs for airdromes. When this material is hit by a bomb, the effect is localized, deadly fragments are not sent flying in all directions.

As in the case of plastics, ingenious minds are busy trying to find new and unexpected applications for perlite plaster and concrete and for dry perlite. Some success has been achieved in this direction, for the material is being used in oil-well drilling, as chicken grits, cleansing and scouring powders, and horticultural products. In drilling an oil well, a soupy fluid is circulated around the drilling tool to cool it and carry off the chips. Perlite serves as a thickener to prevent excessive loss of the fluid through escape into rock crevices. It is similarly used in mudding or cementing off the hole. When perlite is added as a thickener the material can be forced down and up around the pipe with less pressure.

One of the first concerns to mine and process perlite was the Alexite Engineering Division, Florence, Colo., of the

Alexander Film Company. In New Mexico, the largest producer is the Perlite Division of the Great Lakes Carbon Corporation located about 4 miles west of Socorro. There the latter found one of the purest deposits known. (It is highly desirable to provide a material of a good dead white.) All that is needed to mine the stuff is to pick it up with a Caterpillar 80 scraper and carryall. There are several sizable hills in the area that seem to be all perlite, and in the scraper operations the company's contractor has taken 70 feet off the top of one of the hills, and there's no end in sight. How deep the deposits go is not known.

The raw material is moved to a plant equipped with a crusher, screens, and a flash drier. The crusher is of the impact type and has a capacity of 40 tons of head feed per hour. Crushed and dried, the product is loaded on railroad cars and shipped to many points in the United States and foreign markets. The deposits worked by Great Lakes Carbon have the advantage of great uniformity. The corporation holds leases on others in the northern part of New Mexico.

Recently, the U.S. Gypsum Company is reported to have taken leases on perlite deposits near Grants, N. Mex., where some of the finest pumice in the world is produced and processed by the Pumice Corporation of America. In this same vicinity, on lands largely owned by the Santa Fe Railroad, was discovered one of the greatest deposits of low-grade uranium ore early this year. Not far away is New Mexico's principal fluorspar mining district.

A long time ago nature generously scattered a number of materials around the area that are now becoming valuable. Obsidian, too, is found in the region, and obsidian, says the U.S. Bureau of Mines, may be the same kind of lava that perlite is—that cooled quickly under conditions which prevented crystallization of feldspars and other materials. Some obsidian retains its original water content and may be exfoliated by heat.

The exploitation of perlite is so recent that the books haven't caught up with experimentation. In 1946 the U.S. Bureau of Mines stated that "Very little is known about the actual crushing strength of the various grades of perlite. The material, weighing only 5 pounds per cubic foot, is fragile and tenuous but may well prove to be stronger than vermiculite of the same bulk density on account of its cellular constitution. Crushing strength in a concrete or in a gypsum wall board is of greater importance, and considerable research is needed ...."

Experimentation is going on at a lively pace, and many enterprising fellows are building themselves new businesses with perlite created by a whim of nature millions of years ago in a period of great volcanic activity. To quote once more from the Bureau of Mines' 1946 Bulletin: "There will undoubtedly be certain uses where each of these competitors (lightweight aggregates) finds a special field, but perlite promises greater versatility than any of them."

Applications are expanding as fast as the rock itself does under heat, and companies in production are guarding their trade secrets with all the vigor that characterized copper, brass, aluminum, and other industries a couple of generations ago. Whether or not perlite will eventually compete with other aggregates in the field of precast-concrete load-bearing members, it is today probably the most popular of all the lightweight materials for use in plaster.

COLORADO PERLITE MINE

Alexander Film Company's mine in southern Colorado was one of the nation's first. The pictures show a bulldozer clearing away overburden and a portable crushing and cleaning plant for perlite that is dug with a power shovel.

GATHERED AROUND THE GRAVE

The sunken dredge lies in the central area. In the foreground and at the left and right are floats carrying nine pumps and two air compressors. A pump at the left is discharging water brought up from the interior of the vessel through a line placed by the diver, and other lines may be seen extending into the water from the barge at the right. The motorboat in the background was the workhorse of the salvage crew, shoving equipment around where it was needed. It was moored to the dredge when the latter sank, but broke loose and drifted 6 miles downstream.

MAKESHIFT PONTOON

Built of steel plate 3/16-inch thick and intended for storing acid, tanks such as the one shown above were well suited for use as pontoons. A workman is running a cable into a pipe that extends through the tank. After another cable had been passed through a similar opening at the other end, both lines were slung under the sunken dredge by a diver and temporarily secured to a barge on the other side. The tank was next filled with water and slid down the cables, coming to rest against the hull of the dredge. The cables were then secured to the tank by the diver, who used a wedge-shaped split-bolt fastener that drew tighter as force was applied. After another tank had been similarly strung on the cable on the opposite side of the hull, the water in both was displaced by compressed air, thus rendering them buoyant. At one time four tanks were used with a lifting force of 70 tons each.

Salvaging a Sunken River Dredge

Compressed Air Helps Bring Working Craft Up from 70 Feet of Water at Alton, Ill.

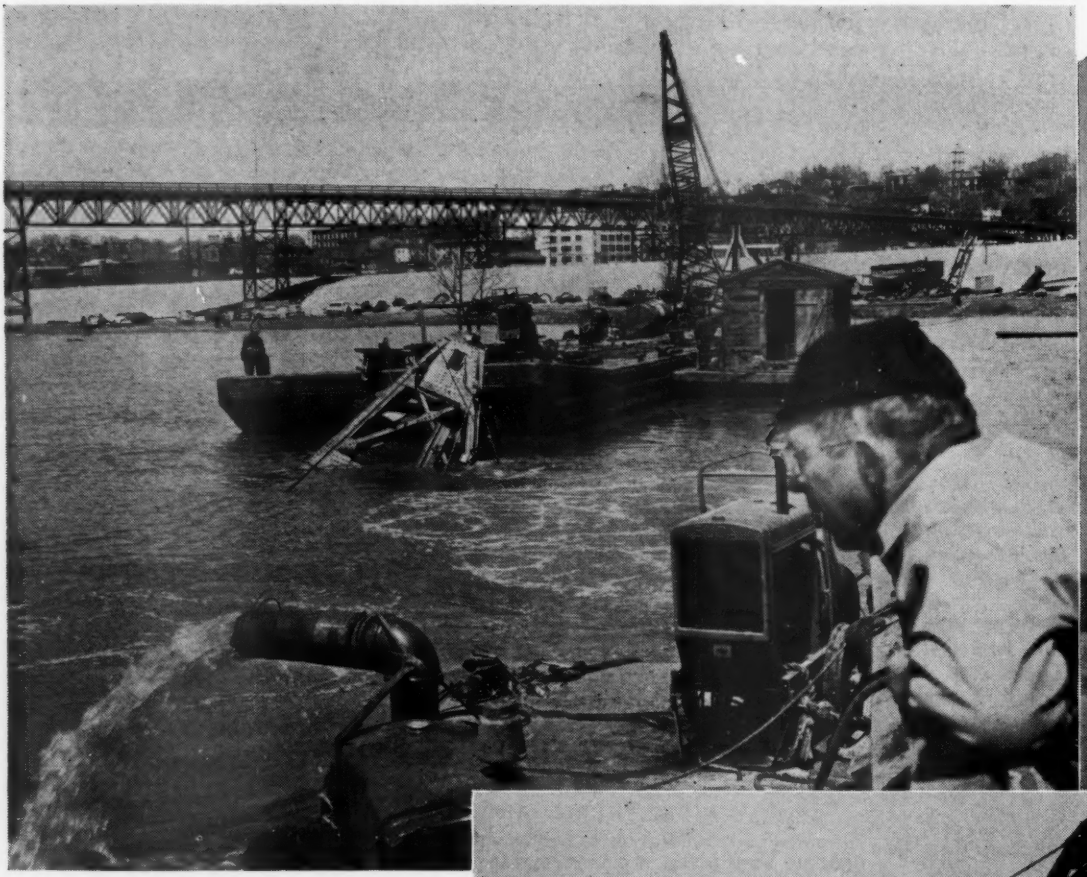
Robert K. Graul

WHAT is thought to have been the biggest boat-salvage job ever carried out on the Mississippi River was successfully concluded in May when the sunken suction dredge *Calumet* was brought to the surface at Alton, Ill. As is the practice in undertakings of this kind, compressed air played an indispensable part in the refloating operations.

The dredge, which had been used to bring up sand from the river bottom for a new levee, foundered in February, three weeks after it had been tied up for the winter by its owner, the LaCrosse Dredging Company, of Chicago. It was anchored directly over a deep ditch that it had just dug and went down in 50 feet of water. At the time of its recovery the river had risen and was 20 feet higher. The cause of its sinking is still undetermined.

The *Calumet* has a displacement of 650 tons, but by the time the salvors got down to their job in earnest, 400 tons of mud and silt had accumulated in the hull, making a total deadweight of approximately 1050 tons to be raised. This was eventually accomplished by means of two buoyancy or lifting tanks connected by cables that were passed underneath the craft and by pumping out some of the hull compartments and simultaneously introducing compressed air to lighten the burden.

When it sank, the dredge came to rest on one side. In order to right it before beginning salvage work a diver fastened cables to timberheads on the hull, and then three tractors, 200 yards away on the river bank, pulled on the lines and brought the vessel to an even keel.



BEGINNING TO RISE

Above, Vernon Parker, of Metropolis, Ill., a leading professional diver, watches closely as air is forced down to compartments in the hull and to submerged buoyancy tanks while the pumps suck water out of the craft. Just short of the barge, in the center, the tip of the steel boom from which the dredge cutter is suspended is poking above the surface.

UP COMES THE BOW

Here one end of the dredge is pretty well afloat, buoyed up by two tanks, one of which is visible at the right. Much of the mud and debris had been flushed from decks and flat surfaces when this picture was taken; but the engine room, towards the stern, still held an estimated 400 tons.

Initial efforts to bring the *Calumet* to the surface failed. At one time four tanks, each with a lifting capacity of 70 tons, had been put in place, two on each side, and connected by cables slung under the hull. However, when the craft shifted position in beginning to rise, the lines snapped.

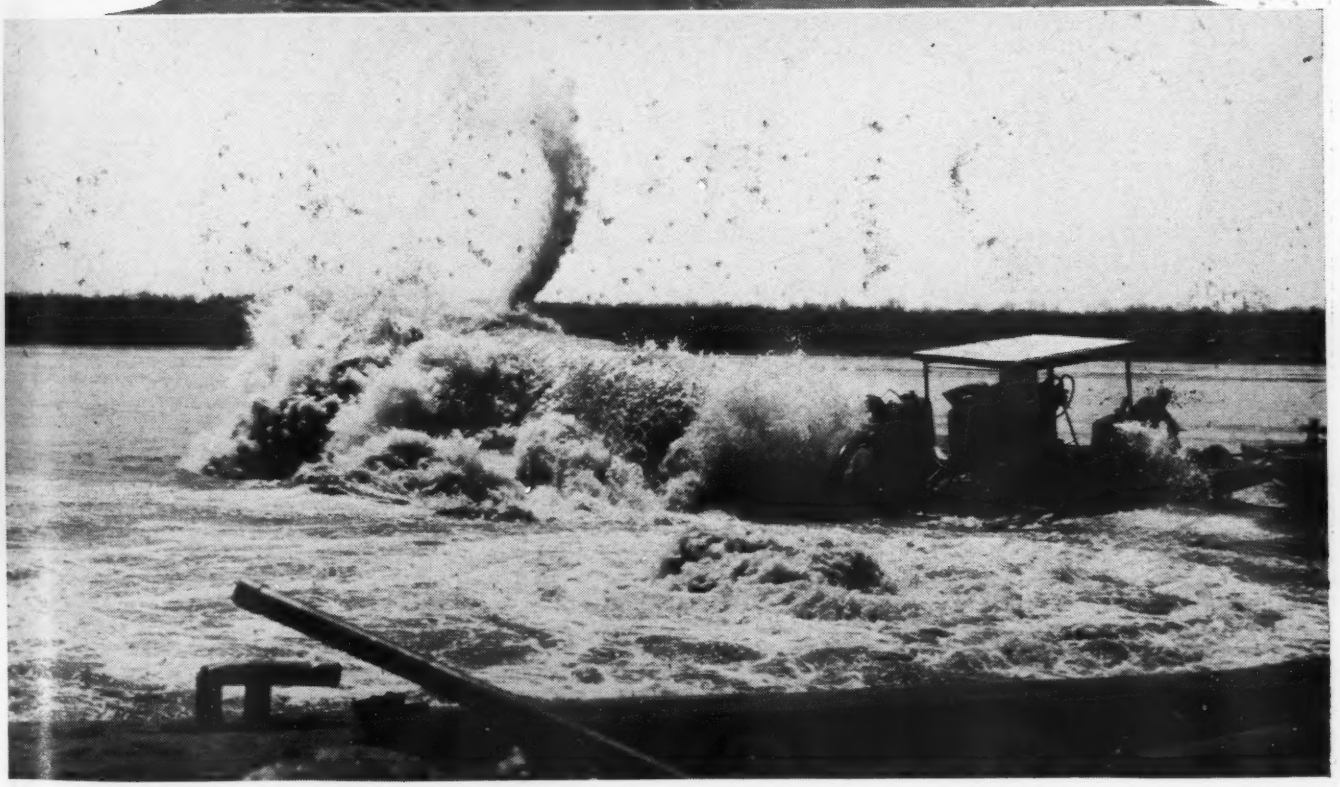
Stronger cables were then obtained for another try, but this time no attempt was made to raise the entire deadweight simultaneously. Instead, the bow end was lifted first, and then the vessel was dragged into shallower water by two shore-based tractors tugging on cables attached to timberheads on the bow. Next, after openings in the deck cabins had been bulkheaded, water and mud were pumped out and air was forced in, thus lightening the stern so that it rose. As it did so, the bow came down and the boat leveled off.

The cutterhead and its supporting steelwork boom extending from the bow of the 100-foot-long hull added to the difficulty of raising and maneuvering the dredge. After it had been brought to the surface, this appendage was supported during subsequent movements by a barge. The refloated *Calumet* was towed to a shipbuilding yard for general rehabilitation. There electric motors have been overhauled and silt scraped out of the bilge and hull tanks. A great deal of work still remains to be done on the craft before it can be put back in service.

The salvage operations were conducted by six insurance companies that shared policies on the dredge. Anton Drabik, of Chicago, was the engineer in charge. Much of the equipment used on the job was supplied by the LaCrosse Dredging Company.

AFLOAT AGAIN

Like an old lady, cautiously venturing out for a swim supported by water wings, the "Calumet" stays afloat with the aid of buoyancy tanks on each side and with its cutterhead at the near end supported by a barge. The "Ray H.," towboat of the Allgire Towing Company, is about to move the digging craft to a shipbuilding yard for a 3-month job of renovation. The two tanks were connected by 1½-inch cables passed under the hull and were made up in a peculiar lay that was calculated to provide maximum flexibility and strength.

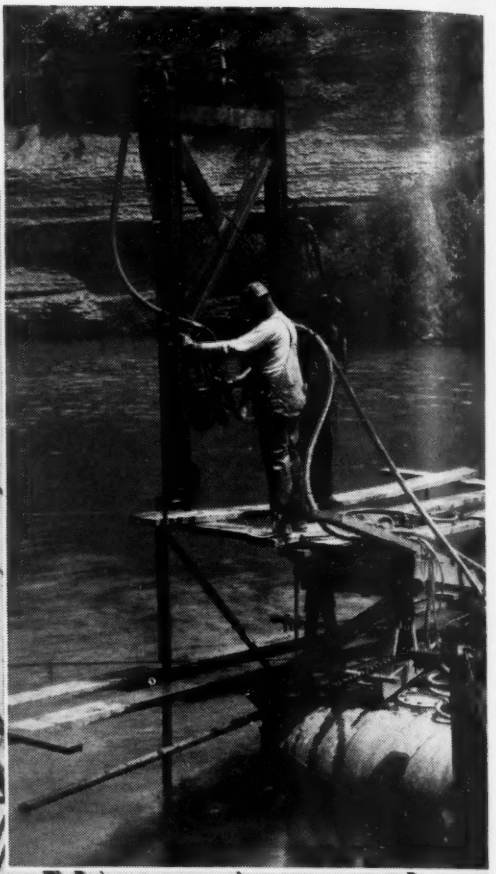


STEEL WHALE BURSTS BONDS

When the cables holding one of the air-filled buoyancy tanks against the hull snapped, the vessel shot up like a cork. Author Graul, Alton Evening Telegraph photographer who took these pictures, caught it just as it was breaking water and considers it the most fortunate shot of his fifteen years as a news cameraman. The motorboat was almost capsized, and the man at the right is grasping for a safety line. Fortunately no one was hurt, but one pump went overboard. Shortly after the tank rose, its companion on the other side of the dredge came up, and a little later the other two broke loose and catapulted to the surface. The mishap delayed the salvage work many days.

UP IN THE AIR

Suspended from the crane's boom is a pipe-line drilling rig mounting two X-71 drifters each fitted with a 24-foot steel, a length that proved just sufficient to reach through the water and penetrate the bottom rock to the desired depth. The inset shows the drills lowered and at work. The near driller has a hold on lines controlling the valve that directs the air through the steel for cleaning the hole.



120,000 Volts Under the Genesee

Contractor Solves River Crossing Problem With Pipe-line Drill Rig

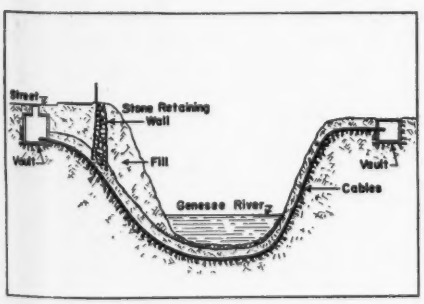
Ted Slager
and
Mike Milano

DRILLS AT WORK

This view shows the double-deck scaffolding erected along the working end of the barge and a row of 2-inch pipes that served as casings through which the holes were drilled. A slot can be seen in the nearest pipe at the bottom of the picture. This was one of several cut just above the water line to permit blowing out cuttings and mud without spattering the drills and operators.

SINCE the year 1892, when Ebenezer ("Indian") Allen built a sawmill and a gristmill at the falls of the Genesee, in Rochester, N.Y., power from that river has been used in the city's manufacturing plants. The Genesee flows through the center of the town in a deep gorge with nearly vertical banks from 50 to 200 feet high and has three cataracts within the limits of the metropolis. The falls have a combined head of 261 feet, and are one of the community's scenic attractions.

While the Genesee is still an important source of energy, the city years ago outgrew the power obtainable from this stream. Today, Rochester, with a population of 331,252 (1950 census), is a community of many beautiful parks, an important educational center, and numbers more than 700 industries, including such well-known firms as the Eastman Kodak Company and Bausch & Lomb. Most of the electric energy now consumed there is produced by steam in central stations.



SKETCH OF OPERATION

To cross the Genesee with cables, it was elected to go under rather than over. The job described here concerns the drilling and blasting of approximately 170 feet of trench in the river bottom, working through about 11 feet of water.

As part of an expansion program, the ultimate goal of which is a generating capacity of 250,000 kw., the Rochester Gas & Electric Corporation is installing high-voltage transmission lines, approximately 35 miles long, from a new central station (Russell Station) on Lake Ontario to substations throughout the city. Eighteen miles of this system is already in place.

In order to reach one of the substations, the Genesee, which once furnished all the available electric energy, must be crossed by high-tension lines that will carry power generated by steam. An overhead crossing was considered, but rejected because towers to support the six heavily armored cables would be unsightly and cost more than laying them under the river bed. A trench was therefore decided upon, which would serve the further purpose of protecting the 5-inch-diameter cables from debris carried downstream by the current, which at times reaches an estimated velocity of 15 to 20 miles an hour. The plans called for a trench 3 feet wide and 3 feet deep excavated in rock at a point in the stream where it is 170 feet wide.

Because of the rocky nature of the river bed the work involved drilling and blasting. A drill boat is normally used for underwater operations and is a pretty massive and expensive affair. Submarine drills are generally heavy bore machines that require large fabricated towers or drill guides, and the associate equipment that supplies the necessary air or steam power is correspondingly large.

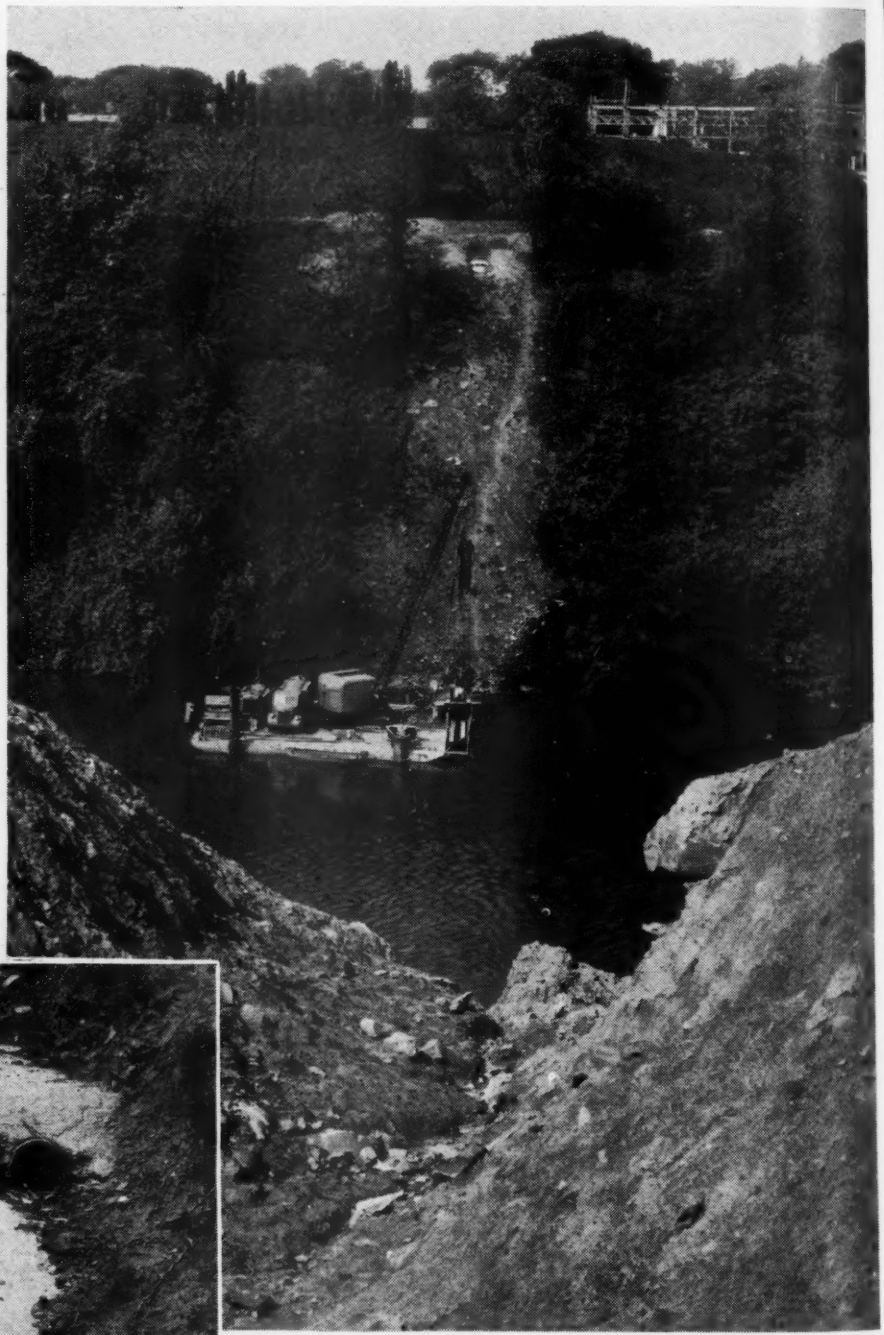
The amount of drilling that had to be done on the job was comparatively small and did not warrant such a big investment. Following a suggestion, the contractor decided to do the work with a drilling rig of the type used in digging trenches on land for oil and gas lines. It consists of two 4-inch-bore X-71 drifters, complete with air-powered chain feed, lubricators, hose, and controls for both drilling and hole blowing and mounted on wagon-drill guides connected by suitable steel cross braces. When operated under normal conditions on land, the rig is generally suspended from a side boom on a crawler tractor and permits putting down two 6-foot holes at a time. The move to the next drilling position takes but a minute.

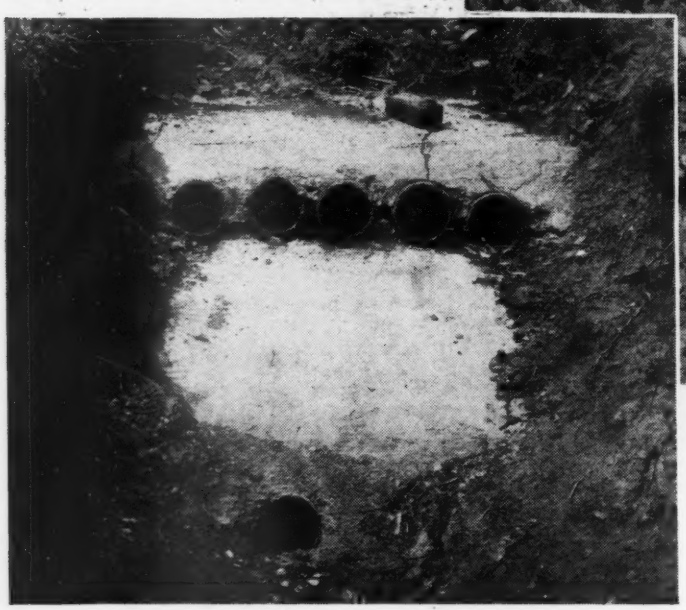
Since the Genesee River has an average depth of 11 feet at the point of crossing and the banks there are approximately 150 feet high and nearly vertical, it was necessary to work from a barge, and the one selected is similar to the utility type employed by the U.S. Army during the last war. It was built in Rochester, and because of its size—about 40x40 feet—it had to be moved in two sections to a launching site some distance below the cable crossing. It was assembled there and run into the water on rails. Two I-R air hoists were installed, one on each side, for lateral control; and another gasoline-driven unit was used to pull the craft up- and downstream. In addition to the pipeline drilling rig, two 315-cfm. portable compressors were put aboard, along with a Lorain crane with a ¾-cubic-yard clamshell bucket.

Two 25-hp. outboard motors, mounted on outriggers fastened to the barge, easily moved the latter upriver to the working site. There it was moored by cable to a convenient bridge pier about 100 yards upstream, and the air-hoist cables for lateral control were anchored, one on each bank. When the craft had been maneuvered into position, spuds on the upstream corners were lowered, thus holding it so that the downstream end was adjacent and parallel to the trench line. Provision had been made for spuds at the other two corners, but it was found that they were not required. Drilling was done from scaffolding extending out from the downstream end.

The drilling rig proved ideal for the small-scale job. It was hung from the crane when in service and readily detached when the clamshell bucket was needed for mucking. Suspending the rig from a crane was advantageous because it permitted the use of drill steels 24 feet long, thus eliminating the time-consuming work of changing steels. It also made it possible to raise the rig with ease and move it to the next location. The holes were drilled in pairs on 32-inch centers and in a straight line across the river. Hollow, round 1¼-inch steel was used with Type 1 Jackbits of 1⅞-inch gauge.

Preliminary digging with the clamshell bucket indicated that the overbur-





LOOKING ACROSS THE RIVER

Above is a view along the line the cables will follow, showing the drill barge working near the opposite shore. A white spot visible high up on the far bank is a concrete structure through which the cables will be run. It is seen at close range in the picture at the left. Although only three cables will be laid at the present time, provision is being made for more.

DRIVING CASING

The pipes through which the holes were drilled were driven into the rock with a paving breaker fitted with a special tool made up on the job.

den was too hard to remove it without blasting. Subsequent operations showed that the horizontal beds of dolomite on the river bottom were covered with an accumulation of 5 to 6 feet of closely packed gravel, cinders, and clay. The contractor believed that he could make the Genesee help him clear away this overburden. To this end he started drilling and blasting in the center of the stream and "clamming" and dumping the shattered rock on the upstream side of the trench so as to form a barrier. This increased the speed of the current and was of great aid in washing away some of the material.

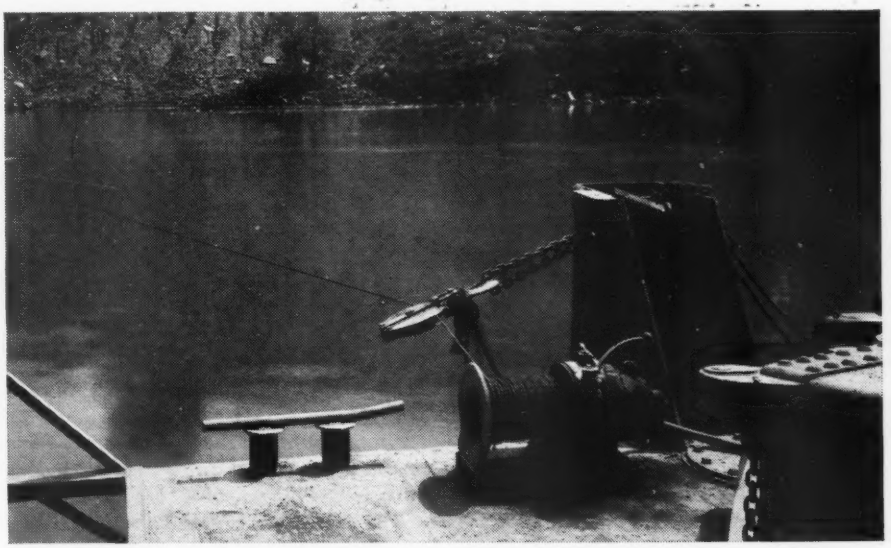
The first holes drilled would not stay open. They became so badly packed with clay that they could not be blown out even with compressed air. The Ingersoll-Rand Company representative who had advocated using the pipe-line rig now suggested drilling the holes through casing. Lengths of 2-inch pipe were procured and proved ideal for the purpose. The casing was pushed some distance into the gravel and clay before the steel was inserted and drilling begun. As the steel penetrated the overburden and rock, the pipe followed. After a foot or so had been drilled in rock, the steel was removed and the casing driven solidly into the rock with a PB-8 paving breaker. This worked well, for after the pipe was in place drilling could be continued until the hole was bottomed 3 or 4 feet below grade. This was done to make sure that enough material would be broken with the first blast.

By use of the casing it was easy to clean out each hole with compressed air. To prevent splashing the workers with water and muck, several slots were cut in the pipe with a torch, thus permitting the cuttings to be blown out just above the water line. The casing not only kept the hole open but also facilitated loading the explosives and protected the primer wiring against breakage by the force of the current, as had happened previously. The pipe was left in the hole during the blast. Then it was salvaged for reuse. Within the limits of the barge it was possible to drill, load, and fire fifteen holes from one setup. Each hole was charged with 90 pounds of 60 percent marine dynamite, and between shots the craft was moved to safety 10 yards upstream by the gasoline-driven hoist provided for that purpose.

The job of trenching the Genesee took exactly two weeks from the time the barge was floated to the first drilling position. The trench is now being extended to a concrete vault high on each shore and will be more than 400 feet long when completed. It will be backfilled after the power cables are laid. The vaults will serve as anchors for the lines and are firmly tied to the rock by steel members so they will withstand the strain to which they will be subjected when the heavy cables are pulled across the stream and up the bank.

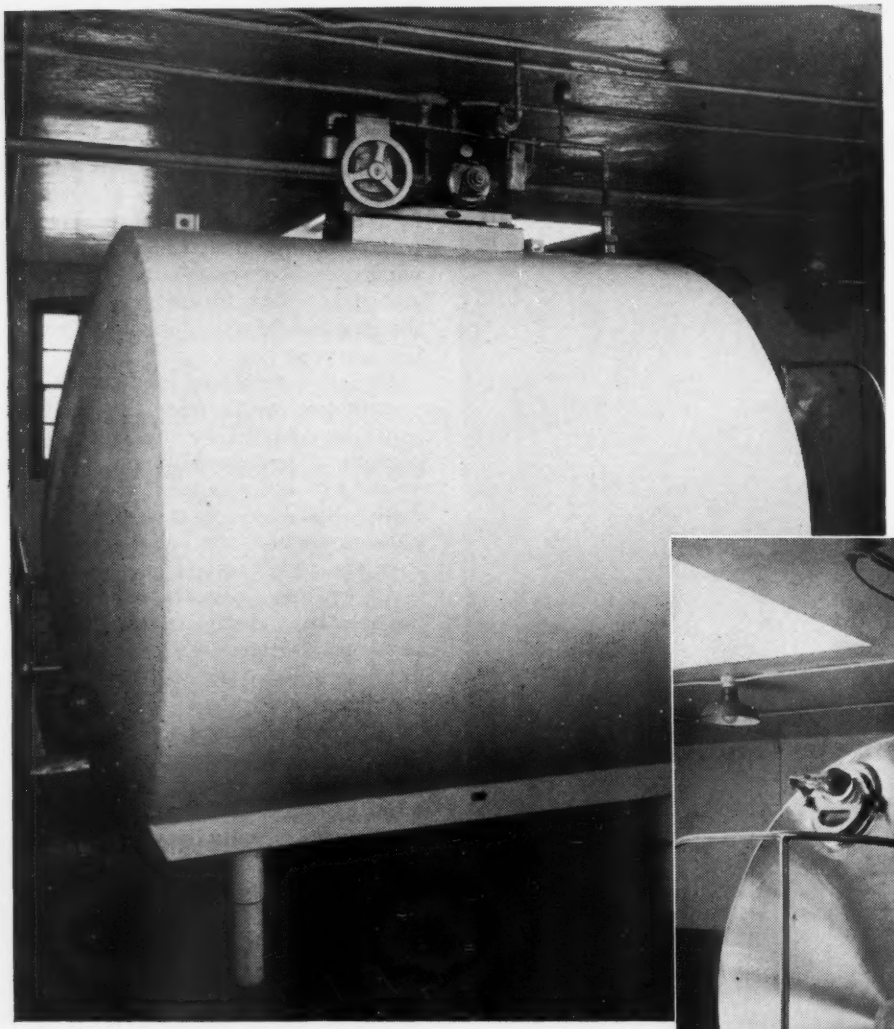
By use of the pipe-line drill rig the contractor was able to carry out the underwater work efficiently and at low cost. It was the only item in addition to the barge that he had to buy; all the other facilities on the job were of the type generally included in the equipment owned by men in the contracting field.

The Genesee River crossing involved in the Rochester Gas & Electric Corporation expansion program represents part of a contract awarded to the C.P. Ward Construction Company, of Rochester, with William C. Knox, superintendent. Rudolph Bower is in charge of the job for the contractor; Arthur Stemp, compressor and crane operator; and A. Villa, powderman.



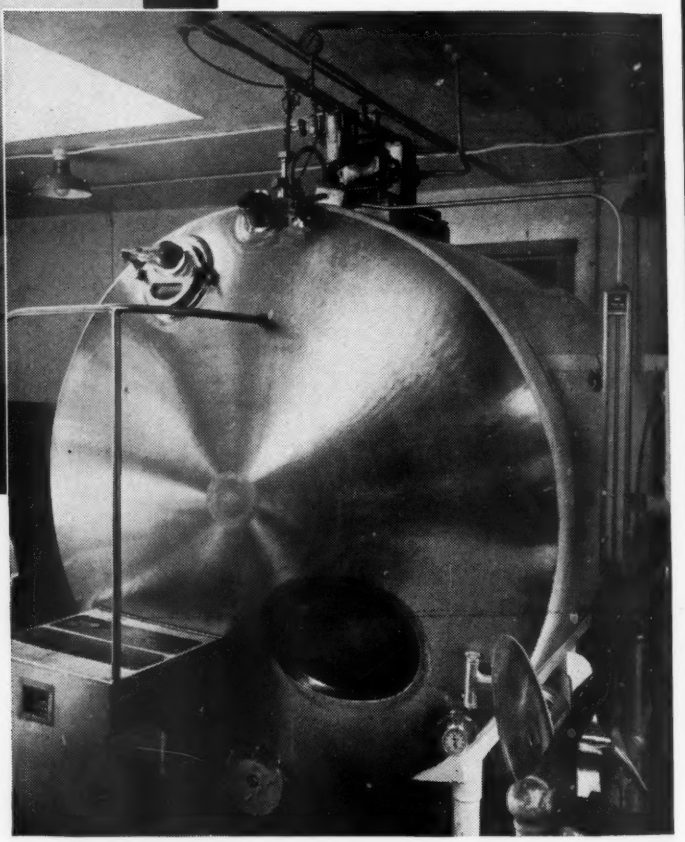
MOORING-LINE HOIST

The barge was maneuvered up- and downstream by a gasoline-powered hoist. When at work, it was anchored to a bridge pier upstream and also to the river banks by lines run from an air hoist on each side of the craft, as shown.



SMALL-TANK APPLICATION

Shown here is a 1600-gallon holding tank with an Ingersoll-Rand ½-hp., motor-driven NL (nonlubricated) compressor mounted on top of it. It is installed in the plant of the Dairymen's League Cooperative in South Orange, N. J. In the picture at the left, the air-intake filter, looking like an inverted cup, is left of the compressor. In the discharge line and right of the motor is another filter. Then comes an air gauge, after which the line turns downward to enter the tank. Note also the existence of interconnecting piping that makes it possible to bring air in from another source should that become necessary. Through the open manhole in the end view of the tank may be seen parts of the vertical and horizontal sections of the air-delivery pipe. They are easily removable for cleaning.



A Good Mixer

Compressed Air Eases Dairyman's Job of Agitating Milk in Holding Tanks

Ralph E. Stork*

AIR agitation of milk (milk products in holding tanks) should interest everyone in the dairy business because it offers many advantages both from an economic and a sanitary standpoint. Time is money. It takes only 2½ minutes to agitate a tank of milk with air, whereas a minimum of twenty minutes is required to do the work with the average mechanical agitator. By the latter method, a 4000-gallon tank calls for the use of from 2 to 3 hp., depending upon the design of the agitator. With air only ½ hp. is needed, and it will do a more thorough job. This is of economic value in two ways: First, less direct energy is required. Second, with less energy being dissipated in the form of heat that has to be extracted from the milk, the refrigeration system has less work to do.

Before proceeding with the subject of air agitation, it will simplify matters to give a description of a typical system of this kind. There is nothing complex about it. The compressor that supplies the air for agitation takes the air from the room in which the tank is located and draws it through a filter on the suction end. Next, the machine forces it through a sanitary filter provided with a drain cock, through a vertical sanitary line extending down into the tank, and through a connecting horizontal pipe close to the bottom. The latter is capped at the far end and has holes on fixed centers on the underside for the escape of the air.

In rising, the air mixes with the milk, thus making the liquid in the lower part of the tank lighter than that above it. This causes the entire lightened mass to travel vertically and to push the heavier fluid outward to the sides where it sinks and is, in turn, forced upward, thus setting the agitation system in motion. Note that the whole assembly is made of standard sanitary pipe, which is usually of stainless steel to prevent contamination and to facilitate cleaning — that there are no moving parts in the milk — that no stuffing box or rotary seal is required.

The size or length of the tank presents no problem in air agitation, in fact the system functions just as well whether the

*Assistant Chief Engineer, Dairymen's League Cooperative, New York, N. Y.

Air Agitation Given Clean Bill of Health

ABOUT nineteen thousand establishments in the country process milk prior to its delivery to consumers. There are periods during the processing when the milk is held in tanks awaiting treatment or bottling. To prevent separation of the cream at such times it is necessary to agitate the milk periodically, and this has traditionally been done by mechanical means.

Bubbling compressed air through a liquid has long been a standard method of agitation in various industries, but until the advent of compressors with carbon rings in the cylinders it was not acceptable for use with milk because of the danger of contamination from lubricating oil carried along with the air. This possibility was eliminated by the NL (non-lubricated) type of compressor in which no oil comes in contact with the air.

About five years ago the Dairymen's League Cooperative, one of the large suppliers of milk to New York City, adopted air agitation in a new plant it erected there, and since then it has extended the service to other plants in its system. In all, it now operates some 50 NL compressors. The accompanying article by the organization's assistant chief engineer, Ralph E. Stork, sets forth the advantages of air agitation as noted by him.

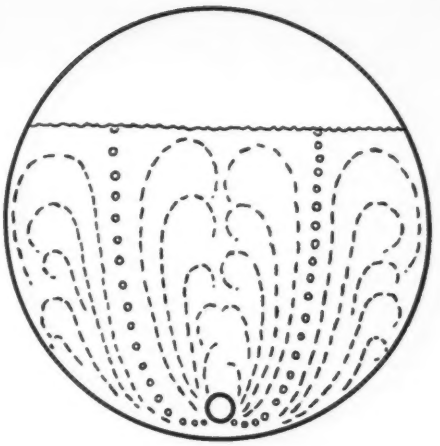
Despite its successful use, air agitation has not attained wide acceptance partly because of the belief among members of the industry that it has certain deleterious effects on the milk other than the one mentioned. It has been asserted, for example, that air reduces the vitamin C content materially and that it imparts an "oxidized" flavor to the milk.

This belief was refuted by tests conducted on May third at a Dairymen's League plant in Elmira, N. Y., under the direction of Dr. R. F. Holland, Department of Dairy Industry, New York State College of Agriculture, Cornell University, Ithaca, N. Y.

A full tank of milk was agitated continuously for 50 minutes with air supplied by an Ingersoll-Rand Type NL compressor. Samples, taken seven times during this interval, were titrated for vitamin C determination, and the temperature was also taken to learn if there was a significant heat rise. The temperature was 41.5°F. at the start, and half a degree lower at the end of the period. The vitamin C content remained unchanged throughout at 17 milligrams per liter. The milk was held in the tank 24 hours, and then air-agitated again for twenty minutes, after which it showed a 1° increase in temperature as compared with the previous day and a drop of 4 milligrams per liter in vitamin C content.

"From these data," wrote Doctor Holland in his report, "we may conclude that no decrease in the vitamin C content occurs during the ordinary 20-minute agitation period; that no unusual drop in vitamin C content occurs even when milk is held for 24 hours following agitation and then reagitated; that air agitation does not significantly increase the temperature of milk under normal operating conditions. Flavor tests made on this milk 48 hours after its first agitation by air gave no evidence of the presence of oxidized flavor.

"It is, of course, essential to note that these conclusions are drawn on the results of a single test. However, I doubt that any significant differences would be obtained in further studies."



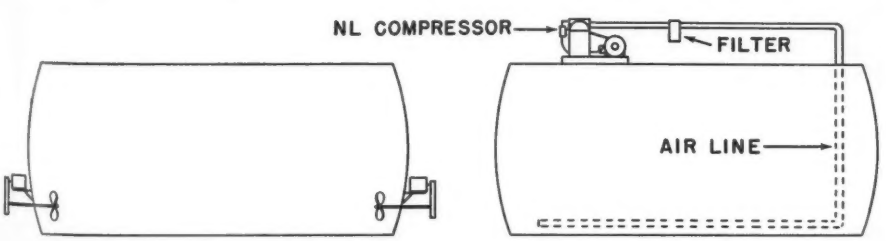
ACTION OF THE AIR

Bubbles, issuing from holes just off center on the underside of the pipe, rise in streams on both sides, forming air lifts that lighten the surrounding milk and cause it to rise. As the streams work upward, they push aside overlying and denser milk, as indicated. This sinks and is in turn lifted. Repetition of this motion sets up a pattern of circulation that insures thorough mixing.

tank is long or short, and the agitating time is the same either way. However, in contrast with mechanical agitation, there are advantages in using a long tank. In the case of, say, a 7000- or 8000-gallon tank, a mechanical system would have to be equipped with two agitators, one at each end, as against one compressor. Further, to meet most health-department regulations, the vessel would have to be provided with two manholes for access, while a tank designed for air agitation needs but one. If horizontal agitators are used, this means that there would have to be sufficient floor space at each end of the tank to permit men to enter.

The shape of the tank does definitely affect the air-agitation system. A tank of round or oval section is best adapted for the purpose, for when the denser liquid sinks, the rounded bottom directs the milk to the center, giving it a rolling motion from the top-center outward and down along the contours of the tank to the agitation pipe, and finally again to the top-center. Although it is impracticable to apply air agitation to a rectangular tank, it might be done by installing a number of horizontal pipes in the bottom.

Air agitation has a decided advantage over the mechanical system because the milk in the tank can be mixed down to the last 4 inches. With the mechanical system, agitation is limited to the level at which the agitator blades are completely covered by the milk so as to prevent whipping air into it. In the case of a horizontal agitator, this means that the fluid in the lowermost quarter of the tank cannot be properly mixed. This is a serious drawback. For example, if the milk in a holding tank is drawn out down to a little below the one-quarter level and the remainder is drained off several hours later, it would not be possible to



COMPARISON OF AGITATION METHODS

The first of the sketches shows a large tank equipped with a mechanical stirring device at each end. This arrangement requires two agitators and motors, two access manholes, and room at the tank ends to withdraw equipment and to permit a man to enter. The other drawing of the same tank pictures it equipped with a compressor and an air-delivery line. The latter, which runs a few inches above the tank bottom, insures agitation of virtually all the milk, whereas the mechanical system cannot be used after the milk reaches a level where the turning paddles whip air into it.

agitate the last of the milk without getting air into it.

Why doesn't the air-agitation system introduce air into the milk? The writer has observed that there will be air in milk if it is raised to the point where it will fall and form a number of spheres or drops. However, in a properly designed air-agitation system the volume of air supplied is regulated so that the milk will rise to the surface with the air (laminar flow) and roll to the sides—the milk will never be agitated so violently that it will splash above the surface and fall back to that level in drops.

It is a matter of choice whether a single compressor is used for each tank or a central air system for a group of tanks. However, in the case of the latter there are many complications such as (1) control of the amount of air fed to the tanks, which, as has just been emphasized, is a very important factor; (2) possible stipulation by health departments that all lines from the compressor to the tanks be of the sanitary type; and (3) operation of the large motor-driven compressor when only one tank is in service.

The writer recommends an individual compressor that becomes an integral part of each tank, like a mechanical agitator. It may be controlled by a push-button starter, so that all that is required to agitate the milk in a particular unit is to press the button. The compressor may be mounted directly on top of the tank so that, if the latter has to be relocated, the machine, piping, and all can be moved right along with it. Existing tanks with mechanical agitators can be converted to air agitation; in fact, the writer has made a number of such changes.

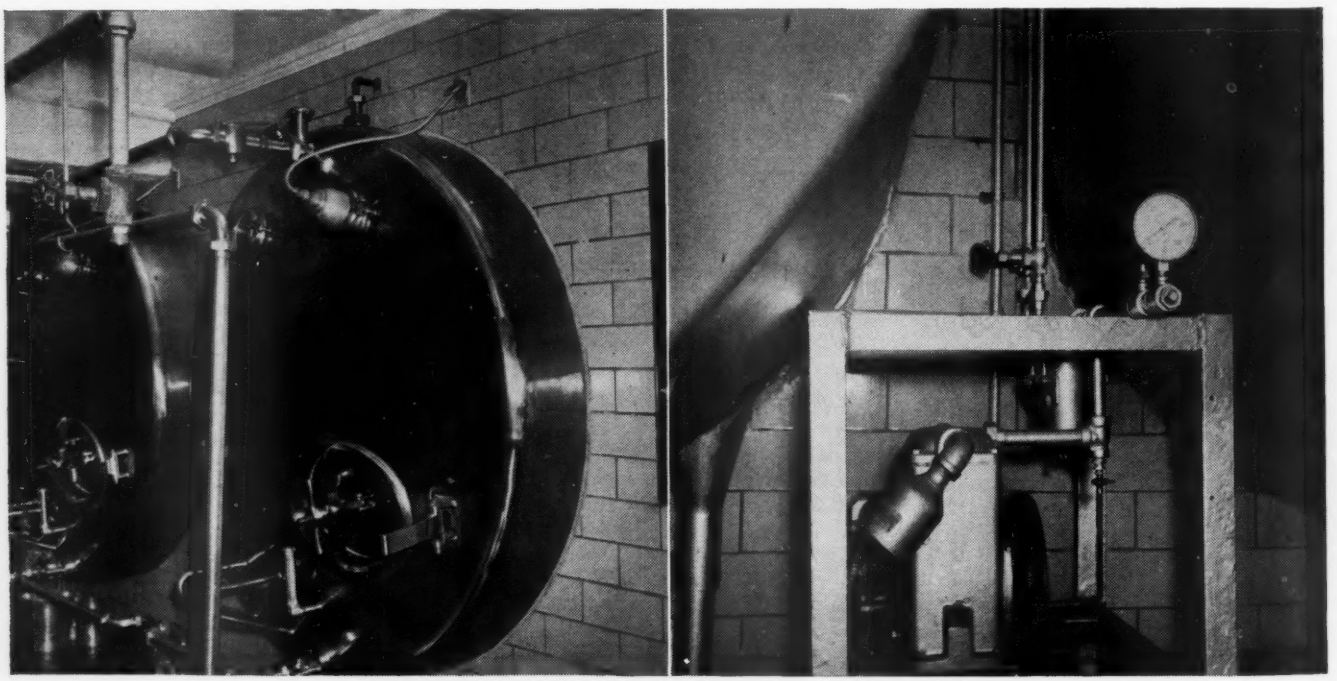
What makes an air-agitation system successful? The selection of proper equipment. The air used must be free of oil. Many dairymen have tried to remove the contaminant by installing condensers, filters, and other gadgets. It is the writer's opinion, formed after a thorough investigation of many types, that it is not possible with these devices to get rid of all the oil. The only way to be sure that none will get into the milk is to choose a compressor that does not require oil to lubricate the cylinder. This is an important point and cannot be stressed too strongly.

Ingersoll-Rand Company builds such air compressors, and the writer has selected this type for approximately 50 tanks. As a matter of fact, the New York City plant of the Dairymen's League Cooperative has nine tanks that are so equipped, and the results have far surpassed expectations. The unit is compact, sturdy, and of simple construction, and ideally suited for air agitation because it has a self-lubricating cylinder. The piston is provided with graphitic-carbon rings that prevent metallic contact between the piston and the cylinder bore and thus eliminate the use of oil and all danger of milk contamination from that source.

There are several pertinent points to be remembered in selecting and installing air-agitation units. First, the compressor should be mounted high enough so that its air inlet and outlet are well above the topmost level of the milk in the tank. If that is done then milk cannot be siphoned into fixed compressor piping and filters. Second, the machine comes equipped with an inlet filter, but there should also be a good sanitary filter at the point of discharge. This filter should be of a type that can be readily taken apart without disturbing the pipe lines for filter-element replacement and cleaning. It should have a condensate and scale section, as well as a drain and pet cock at the bottom so that it can be blown down daily. Dollinger Corporation makes such a filter. The discharge end of the filter should be connected to a sanitary line, and from there on removable sanitary pipe should be used. A single service filter is sometimes interposed in this line by order of some health departments.

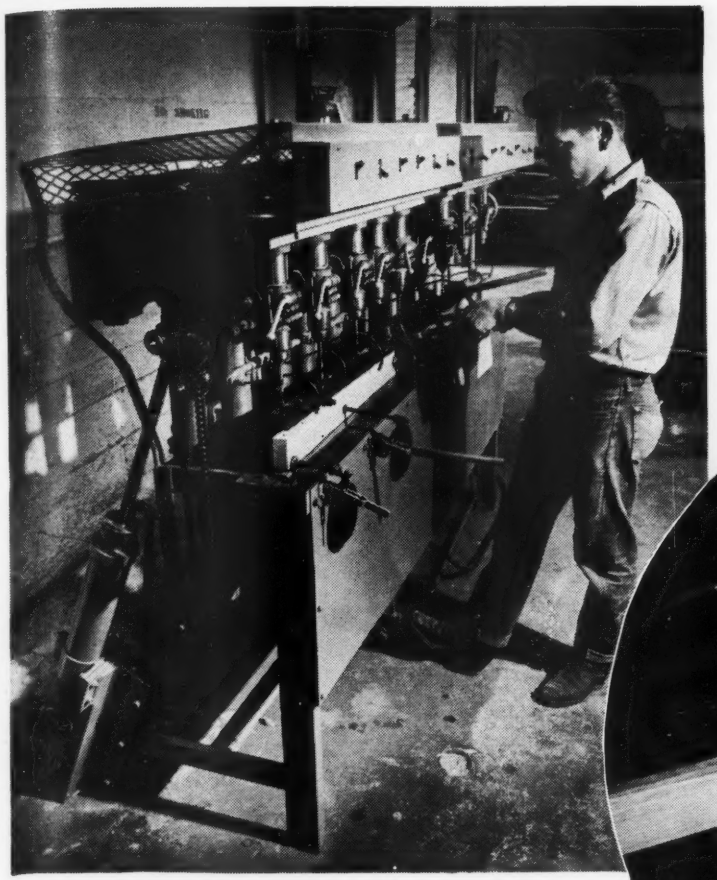
The sanitary-pipe assembly inside the tank—in the milk area—should be made with threadless fittings, and the writer suggests that it be designed so that the work of assembly can be done by reaching in through the manhole. The horizontal agitating pipe should not lie on the bottom of the tank but should be placed about 2 inches above it.

At first, most health departments were skeptical about air agitation. However, when they learned that compressors were available that did not require oil to lubricate cylinders, and tests convinced them that the air entering the tanks after passing through filters and piping was just as sterile as the air in the plant, they were willing to accept it.



LARGE-TANK SERVICE

Following a 2-year trial of agitating milk in two 3000-gallon tanks with air, the Model Dairy of Wm. Weckerle & Sons, Inc., Buffalo, N. Y., is changing seven additional tanks over to the air system. An Ingersoll-Rand NL compressor is shown at the right between the two units it serves. At the left are pictured the front ends of he tanks. The small pipe extending through the tiled wall and entering the top of the near tank is the air line.



TWO AIR AIDS

Side members and crosspieces of truck handles are brought together quickly and positively by the squeezing action of an air cylinder in the fixture pictured below. The other view shows an ingenious setup for the multiple drilling of holes in truck handles. With a foot pedal the operator admits air to the cylinder on the left. The rack extension of its piston turns gears that feed up to fourteen drills simultaneously.

Factory Air Power Pays Off

Kenneth Dawson*

DATA AND PHOTOS BY COURTESY OF COMPRESSED AIR & GAS INSTITUTE

THE liberal application of compressed air has increased production and reduced operating costs at the Food Machinery & Chemical Corporation's Packing Equipment Division in Riverside, Calif. The most recent step in this direction was the factory-wide adoption of pneumatic tools wherever that was practicable. There were numerous reasons for changing from other types. Take, for example, the case of a small air-operated grinder that drives a cone-shaped abrasive wheel at 17,500 rpm. It is used for grinding tube orifices that have been drilled and milled and for removing sharp edges from machined cams. This work is now performed in half the time previously required, and there is also a worth-while saving in wheels. High-speed operation of grinders—some making up to 25,000 rpm.—can be obtained only with air power and is of advantage, for at low speeds the wheel rather than the surface worked on has a tendency to wear as well as to bounce and produce flat spots.

In addition to grinders, the pneumatic tools used in the plant include polishers, brushes, chipping hammers, drills, and impact wrenches of varying kinds and sizes. Some of these have replaced hand tools and others power tools of different types. But all are effecting production economies. For instance, by substituting an air-operated impact wrench for a hand wrench, output has been multiplied three or four times on an assembly job where six bolts and nuts are tightened on a truck handle. In considering the cost of the changeover to pneumatic tools, the company took into account not only production economies but also the lower maintenance and replacement cost of portable tools powered by air. The latter item in itself justified the expense involved.

Management welcomes the savings and workers like the way the tools operate. They are pleased, for example, because an air tool gets cooler rather than hotter with continued use. They have also found out that where relatively heavy equipment is required the pneumatic type is invariably lighter and reduces worker fatigue. Because of these advantages and ease of control, employees have become adept in handling these portable tools and are more confident about their own safety. By means of them, the final stage of a drilling operation, for instance, can be completed with a creeping action and without fear of whipping so likely to occur when a one-speed tool is utilized.

Portable tools, however, by no means account for all the applications of compressed air. The Riverside plant turns out a complete line of citrus-fruit and vegetable packing-house equipment, including such varied products as box stackers, washers, automatic juicing machines, electronic counters, different types of conveyors, and box trucks. Their only point of similarity is that all are used in packing houses. As a result, manufacturing processes are extremely diversified and compressed air, because of its adaptability, is exceptionally well suited for work under such conditions.

Drilling holes in hardwood handles for clamp and box trucks offers a good example of how air power was applied to

*Production Manager, Food Machinery & Chemical Corporation.

advantage. Up to fourteen holes are drilled in a handle, the exact number depending upon its size and purpose. The company sought a way to put them in all at once rather than separately. It was simple enough to arrange a multiple-drill fixture, but providing an automatic drill feed was another matter. Mechanical feed, embodying a clutch and elaborate mechanism, involved not only a high original investment but also high maintenance cost and parts replacement, which go hand in hand with an intricate assembly having many moving parts. The problem was solved by the use of an air cylinder which operates the feed through a rack and pinion.

An accompanying illustration shows the shop-devised air feed, which works as follows: A handle is placed in the drilling fixture, and at the touch of a foot pedal the operator actuates the air cylinder, which turns a chain drive at each drill. The speed of the feed is easily regulated by changing the air volume or pressure, and the positive though cushioned action of the compressed air gives the desired feed motion. This machine makes it possible to run nine drills on top of the handle, four underneath it, and one at the back—all simultaneously.

Many other air-powered devices were developed by production men for service in the plant. Among them are mixers for Flavorseal, a liquid that is applied to citrus and other fruits to seal in the flavor and moisture content. It must be stirred slowly at the start, and almost whipped during the final stage. This calls for variable mixing speeds, and to obtain these with the least amount of special apparatus, air motors from old pneumatic tools were applied to the work of turning the agitators in the tanks.

Air jets are used in all departments for cleaning. On machine work, they not only do the job much faster than brushes but are also more positive in their action, thus precluding the possibility of failure to remove chips, which would affect the precision of the next cutting operation. Another service performed effectively by air jets is ejecting work from punch presses. In punching a stator plate, for example, an air line is attached close to the work so that the finished part will be blown from the die into a slot at the back of the machine, where it slides down over a post on which it is stacked. The jet is actuated by a cam on the crankshaft of the press. As the crankshaft revolves, it acts on the cam at the point where punching is completed and just as the return movement starts. This arrangement permits the press to function safely at full speed without any extra motion by the operator.

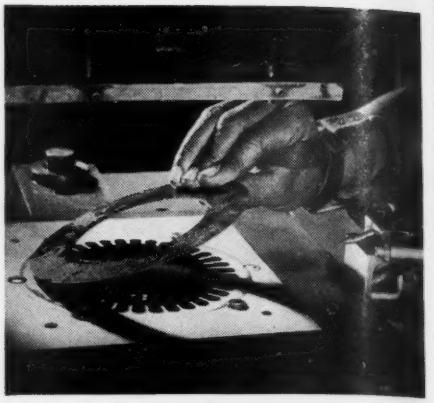
Machine-shop operations are improved by the use of air chucks where loading and unloading time is a factor, as well as by pneumatic fixtures for quickly positioning and holding work on such equipment as milling machines. Another interesting application is on a thread-cutting lathe where slow steady feed and quick return are obtained by an air ram, thus saving time and considerable manual effort. The ram acts on an oil cylinder to step up power and to exert uniform pressure from beginning to end of the operation.

Air clamps and vises are receiving increasing attention. One good illustration of the numerous services they perform is the assembly of hand trucks. As an accompanying picture shows, their two wooden handles are placed in a fixture, together with two crosspieces. Then an air cylinder, 6 inches in diameter, pushes the assembly together in one motion. This method is more than twice as fast as the former one, keeps the assembly tight and true, and prevents splitting the wood, which happened often when the parts were forced together by hand.

Possibly one of the most important contributions made by air power towards plant efficiency is in loading and unloading heavy parts and machinery from trucks. Air-operated lifts are installed throughout the establishment for the purpose and eliminate rigging, take up no overhead space, and greatly facilitate the movement of factory output.

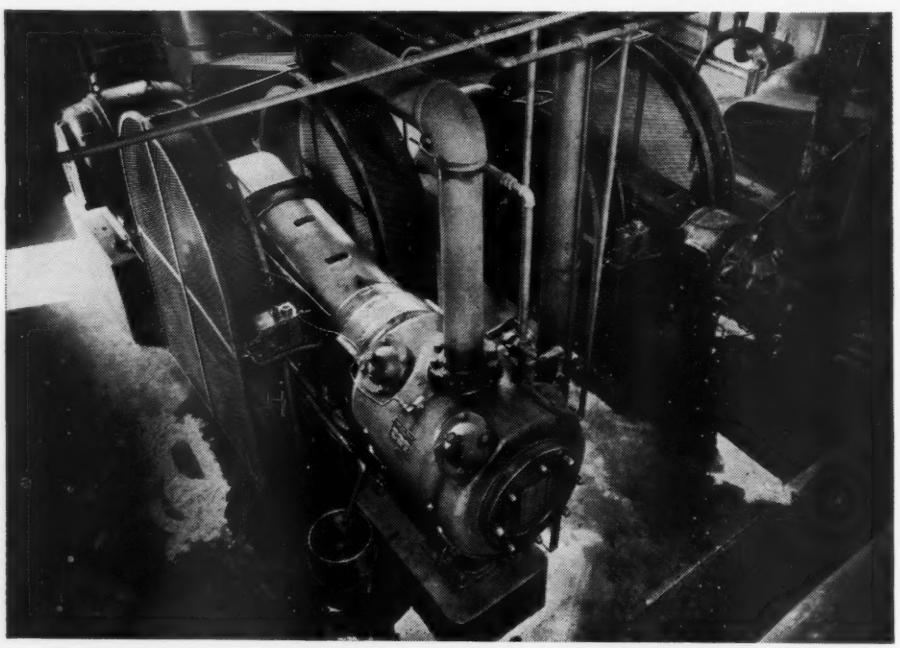
Most of the air comes from a central compressor plant that includes two single-stage machines and one 2-stage unit. The largest of them—a single-stage compressor—is driven by a 60-hp. motor and is the principal daytime source of power. The other single-stage unit, operated by a 30-hp. motor, normally carries all the load at night and is cut in during the day when demand requires it. The 2-stage machine is driven by a 40-hp. motor and serves largely as a standby. The air is distributed by a loop system, with convenient outlets, which equalizes the pressure throughout the 400,000-square-foot factory.

The central plant produces air at around 100 psi. pressure for the varied applications mentioned, as well as for spray painting, sandblasting, and other purposes. Small, portable compressors are used to some extent for maintenance spray painting and blowing the factory whistle or fire alarm. But the central plant, with lots of reserve, is the main source of energy that makes it possible to save time in performing many jobs.



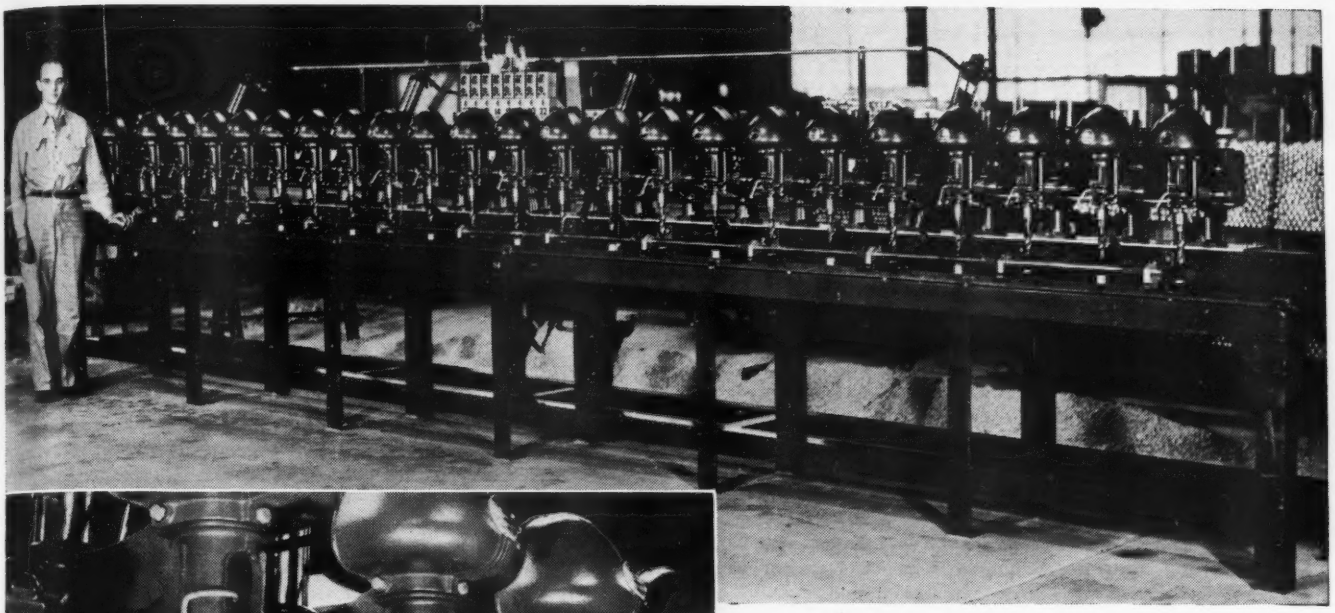
SPECIAL DELIVERY

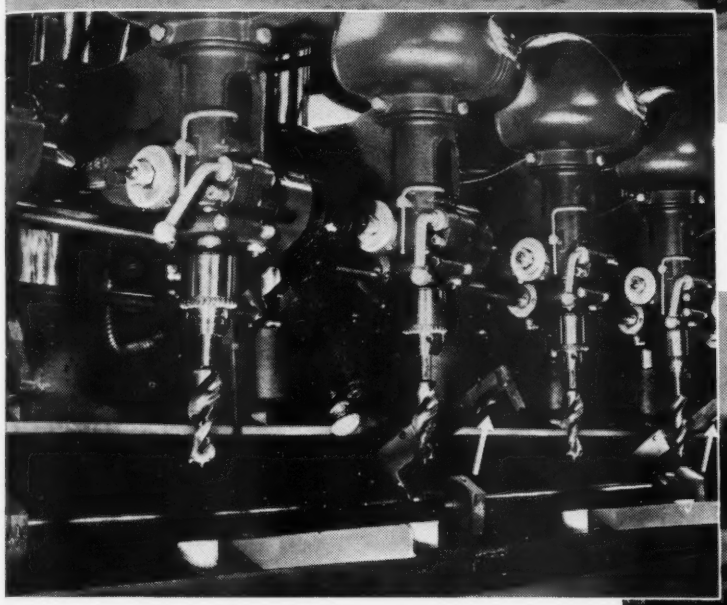
The operator is positioning a stator plate in a punch press. Upon completion of the stroke the plate is dislodged by a puff of air from the jet just under the man's wrist. The blast blows it into a slot at the rear of the machine, where it slides over a post. Below the jet is the nozzle of an air gun used for cleaning.



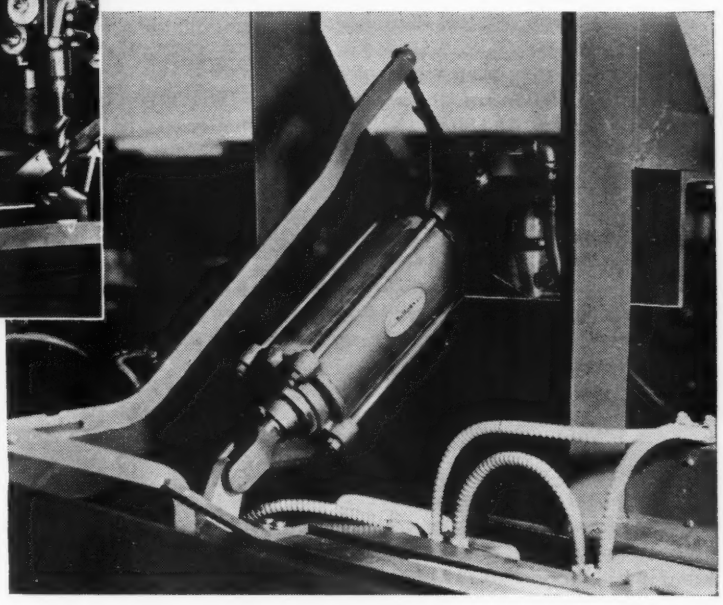
AIR COMPRESSORS

The 60-hp. unit on the left normally carries the daytime load. The other machine, of 30 hp., is cut in when needed and takes care of all the requirements at night. Both are Ingersoll-Rand Class ES, single-stage models.





Big Drill Press Steps Up Ladder Output



BORES TWENTY-THREE HOLES AT A TIME

Pictured at the top is the big Delta drill press which bores countersunk rung holes in more than a mile of ladder side rails daily in the factory of The Bauer Manufacturing Company. It is shown with its designer, Clarence Bucher, the firm's plant engineer. Two of the eleven pneumatic clamps that hold each rail securely in drilling position are indicated by arrows in the view above. The air cylinder (right) which lowers all the drill heads simultaneously by means of a master control is mounted beneath the steel framework.

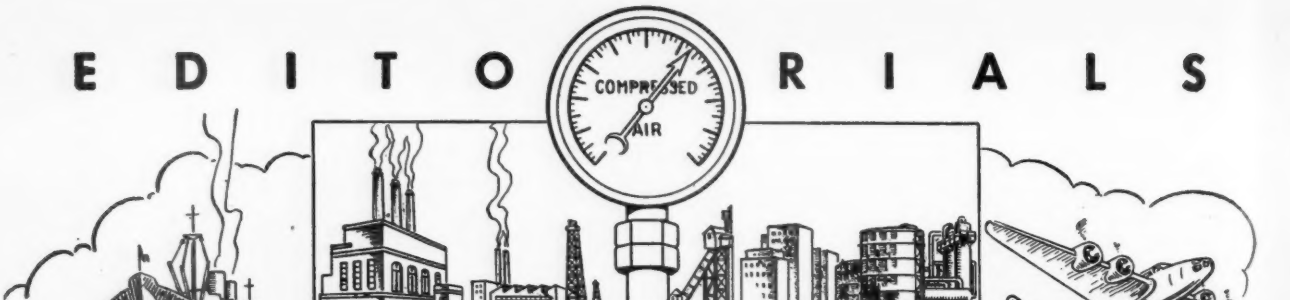
WOODEN ladders turned out by The Bauer Manufacturing Company differ in one vital respect from the usual run, and this, together with speed of production, is made possible by multiple presses designed by it and equipped with drill-press heads built by the Delta Power Tool Division of the Rockwell Manufacturing Company. The biggest of these machines is made up of 23 single-spindle drill heads which, in one operation, bore all the rung holes in side rails for ladders up to 22 feet long. Each rail is held securely in place on a steel-frame table by closely spaced clamps that are actuated by air cylinders, and the spindles are simultaneously lowered into working position by means of a pneumatic cylinder with air at a pressure of 60 psi. The drills are controlled in series from a switch panel at the back of the press, the number in service depending upon the length of the rail.

There is also a smaller machine with nine spindles that is used in the manufacture of stepladders. In this case the side rail is held in a slanting position on the worktable and the drill heads are graduated in height because the holes must be bored at an angle to permit proper spread of the ladder from top to bottom. The spindles are also lowered at one time by a pneumatic cylinder, and individual switches permit cutting in the number required.

The difference between Bauer and ordinary rung-type ladders is that the holes are countersunk; that is, two holes of varying diameter are drilled in one. First, each bit bores a 1⅛-inch hole to a depth of 1/16 inch, and from that point on through the diameter is reduced to ⅞ inch to accommodate the tenon of the rung. This is an intricate operation because all the holes must be uniform to insure the prefabricated rungs a perfect fit.

Standard-size rungs are 1⅛ inches in diameter. The advantage of countersinking is an increase in supporting surface; that is, the weight of the person on the ladder is borne by the full 1⅛-inch rung instead of the ⅞-inch tenon, as is ordinarily the case. Since the large new press was put in operation, production has been stepped up from 30 to 65 side rails per hour.

EDITORIALS



GET IN THE SCRAP

THE ferrous scrap-metal shortage is serious, warns the American Iron and Steel Institute. A 60-day supply for steel mills is normal, but many of these establishments have enough for only a few days. They are living from hand to mouth, unable to build up inventories. Unless the situation improves materially, production of steel may have to be curtailed.

Steel mills purchase most of their scrap from junk dealers. This year they will have to buy 32,500,000 tons of it, 3,500,000 tons more than last year. If they are to get it, more must be moved to the dealers. The biggest source of scrap, of course, is industry itself. Factories that fail to dispose of obsolete or worn-out machinery and metal structures may, later on, be unable to obtain all the steel they will need to carry on their own operations.

Top officials in business, industry, and local governments are being urged to look around and see what scrap they have, and then do something about getting it into the nation's furnaces and cupolas. There is plenty of scrap available, but much of it is dormant. If you know where any of it is, you can help your country as well as yourself by getting it moving.

OIL FROM DEPLETED FIELDS

IN SOME of the nation's older oil fields, notably in Pennsylvania, where pumping is no longer of avail, secondary recovery of petroleum is important and water-flooding is one of the principal means employed. Coring of the oil-bearing formations reveals, however, that it is not unusual for as much as 25 percent of the residual oil to remain in the ground after flooding has been completed. Recent research indicates that up to 75 percent of this oil can be recovered by adding carbon dioxide to the injection water. The method involved has been patented by James W. Martin, consulting engineer of the Oil Recovery Corporation, of New York City, and is being subjected to further testing in the Appalachian field.

The disclosures corroborate the results of investigations conducted at Pennsylvania State College ten years ago and are supplemented by the work of a graduate student in 1947. These studies indicate that other gases, among them ethane and propane, might serve the same purpose, but they were rejected as being too costly.

The action of the carbonated water is thought to be both chemical and physical, and it is certain that it does not appreciably add energy to the reservoir. One effect noted is that it reacts with some of the petroleum components to form fatty acids and their salts, and these reduce the surface tension that holds the tiny globules of oil to the grains of sand. Because carbon dioxide is soluble in either oil or water, it will penetrate to the rock surfaces regardless of which of the liquids covers them.

Tests indicate that the oil yield increases with the amount of carbon dioxide used, but that the rate of increase becomes slower after around 30 percent has been added. The suggested degree of carbonation is around 25 percent. Mr. Martin believes that 75 percent of the carbon dioxide injected can probably be recovered for reuse from the oil obtained. He has expressed the opinion that carbon dioxide can be produced for around $10 to $15 a ton at field sites, and estimates that 12 tons would supply the daily needs of a 100-acre tract.

Along kindred lines is a report made last month to the Third World Petroleum Congress in the Netherlands by Dr. Claude E. Zobell, professor of Marine Microbe Biology, University of California, on the relation of bacteria to petroleum output, a subject he has been pursuing for ten years. He has found that bacteria serve to release oil from sandstone or limestone rocks to which it clings in underground reservoirs. He thinks they do this either by pushing it off or by providing a wetting agent that breaks the grip of the oil. Inasmuch as some bacteria are known to produce carbon dioxide in petroleum, it may be that this gas is the agency that releases the trapped oil. In other words, perhaps Mr. Martin and Doctor Zobell are talking essentially about the same thing.

TOO FEW ENGINEERS

AMONG current shortages, one that industry is beginning to feel acutely, is the scarcity of new engineering graduates. The dearth of embryo engineers results from a combination of circumstances. Following World War II, colleges were jammed with veterans who took advantage of the opportunity to get an education at government expense. Among the fruits of this scholastic movement were 50,000 engineering graduates in 1949, too many for the nation to absorb, especially as it was at the moment in a peacetime economy. Now, with the country girding for defense and the demand for technological help rising, there is a declining trend in the crop from the colleges largely because of the inroads being made by the military services.

Dr. Karl T. Compton of the Massachusetts Institute of Technology predicts that engineering schools will turn out 32,000 graduates next year, 22,000 in 1953, and somewhere between 12,000 and 15,000 in 1954. Meanwhile, he describes the present demand for certain scientists and engineers as "hysterical." Admittedly, the matter will get worse before it gets better. Suggestions for alleviating the shortage include inauguration of engineering training programs for industrial employees and, possibly, a national scheme of allocating available engineers to jobs where the need for them is greatest.

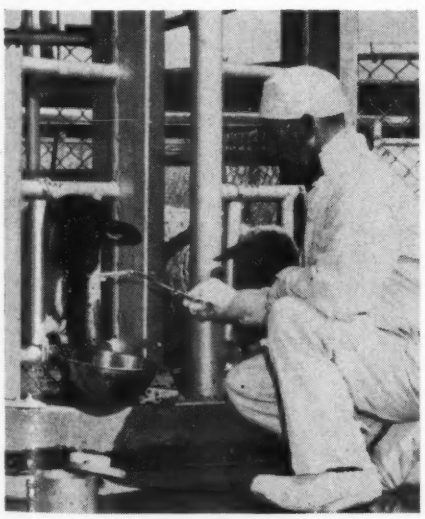
It is to be hoped that the officials of high schools and preparatory schools are aware of the critical shortage and will induce more of their graduates to enroll in engineering courses when they enter college.

This and That

Hanford Works Radioactivity Not Hazardous

Extensive investigations, which are continuing, indicate that the water and gases released from the huge plutonium-producing Hanford Works at Richland, Wash., offer no threat to the health and well-being of humans and animals. Water that cools the nuclear reactors is pumped from the Columbia River and then returned to the same source. To test its effect on fishlife, General Electric Company, which operates the works for the Atomic Energy Commission, has been hatching and raising some 25,000 salmon annually in water that has a much higher radioactive contamination than any issuing from the plant. After observing the effects on the fish, the conclusion was reached that a person would have to eat 100 pounds at one sitting in order to absorb an appreciable amount of radioactive material from salmon taken from the river downstream from the works.

The gases discharged from an atomic-energy plant may contain minute quantities of radioactive iodine, and there is a possibility that some of it might be absorbed by vegetation which is a source of food for animals. To determine how material thus ingested might affect stock slaughtered for human consumption, 200 sheep are under study. They are fed balanced diets of alfalfa, grain, and food pellets. The latter have small holes in them in which are inserted varying amounts of radioactive iodine. Even sheep getting maximum dosages, which would be considered fantastically large outside the laboratory, are virtually unaffected by it.



WELL-FED SHEEP

Two hundred ewes wax fat on a special diet that includes radioactive iodine at the Hanford, Wash., plutonium works. Here a member of the Health Instruments Division offers a tidbit to one of the animals.

In checking the effect of the works on its surroundings, technicians travel each month a distance equal to halfway around the earth. They take 4000 samples of drinking water each month and 900 from test wells to keep track of seepage. Air samples taken average 12,000 a year. These were formerly obtained from as far as 150 miles from the plant, but they were so innocuous that stations are now maintained only within a radius of a mile or two.

★ ★ ★

Old Drill Holes

Old drill holes in rock were in the news twice recently. Nineteen years ago, near Bridgeport, Ala., S.L. Rorex drilled some blast holes in a quarry operated by the Tennessee Valley Authority and put wooden plugs in them to keep out dirt. Then the quarry was closed. Last month work was resumed, and powdermen removed the plugs, put dynamite in the holes, and fired it. Rorex was among those who witnessed the blast.

"Tain't bottled in bond. It's homogenized. That's why it's thirty cents a gallon."

The second set of holes figured prominently in an article in the June 9 issue of *The Saturday Evening Post*, and they are really ancient for they date back some 9½ centuries. The article concerns the supposed visits of Norsemen to our shores long before Columbus arrived. It recounts the painstaking procedure by which Fredrick Pohl, a Brooklyn school teacher, traced and sifted every available bit of evidence and reached the conclusion that Leif Ericson, son of Eric the Red, built a home on the Bass River on Cape Cod, Mass., in the year 1003 which was afterward visited by other vikings from Greenland.

All Pohl had to go on were old Norse writings that describe a new country they called Vinland or "wine land," signifying that grapes grew there. Piecing together the meager clews, he studied the eastern shore from Labrador to Georgia and decided that the description best fitted the Nantucket Island-Cape Cod area. The records tell of the ship entering a river that led to a lake, where Leif anchored, went ashore, and set up camp. The Bass River opens into such a lake—Follins Pond—and Pohl is sure he has found the right place.

"Are you sure this is the tunnel marked here on the road map?"

To clinch the soundness of his theory, he began looking for drill holes in rocks. He hoped to find them because he had learned through his investigations that medieval Norsemen cusfomarily drilled mooring holes for their vessels in granite boulders along the fiords of Greenland and Norway. The stern of the ship was anchored to an iron pin placed in the hole, while an anchor was dropped at the prow to hold the craft securely and to prevent it from swinging around in the wind and damaging itself on the rocks.

Pohl reasoned that the seafarers would have followed the same procedure here. By diligent searching he located not just one such hole but three. The deepest penetrates a boulder to a depth of 11 inches, and the indications are that all of them were chiseled and could not have been created naturally. There is no reason to suppose that they might have been drilled in modern times as blast holes. Having found these holes, presumably hammered into the rocks by Norsemen's muscles, Pohl ceased his detective work, satisfied that he had solved the riddle of the voyage of Leif the Lucky.

★ ★ ★

New Jersey Turnpike On Schedule

Engineers expect to have the New Jersey Turnpike ready for opening on November 1, as scheduled, but weather conditions will control the actual date. The new 118-mile superhighway will extend most of the length of the state, connecting George Washington

Bridge across the Hudson River at the north end with a new span across the Delaware River at the south. The latter structure is a $40,000,000 memorial to the war dead of the State of Delaware.

To June 1, contracts aggregating $183,500,000 had been let to 110 concerns for work on the road, and the final cost will run to $230,000,000. Rock work was comparatively light, totaling only 188,000 cubic yards, but 51,000,000 cubic yards of earth was moved to fill in marshes and low areas and to provide a roadbed which nowhere exceeds 3 percent in grade. Bridges and other concrete and steel structures number 263, of which the longest is a 7100-foot crossing over the Passaic River. Some paving is underway, and it is planned to start the remainder so that all will be laid by October 1.

The legislatures of both states concerned have authorized the construction of a link to connect the New Jersey and Pennsylvania turnpikes. This would cross the Delaware at or near Trenton and skirt Philadelphia on the north to join the existing Pennsylvania throughway near its present eastern terminus at King of Prussia. It would considerably reduce the time and effort of driving between New York and Pittsburgh. As is true of all superways built recently in eastern states, tolls will be charged travelers on the New Jersey Turnpike.

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Cane Sugar Facts

Interesting information concerning the culture and processing of sugar cane is given in the annual reports of Waialua Agricultural Company, Limited, which operates in Hawaii. Development of a new variety that has a greater sugar content than older ones enabled the company, in 1949, to produce for the first time 60,000 tons of sugar from less than 5000 acres of land. In 1950 the yield again increased to 65,029 tons. The cane runs around 95 tons per acre, which is matched by an older variety. However, the new one yields approximately 2 tons more sugar per acre than any other strain so far produced.

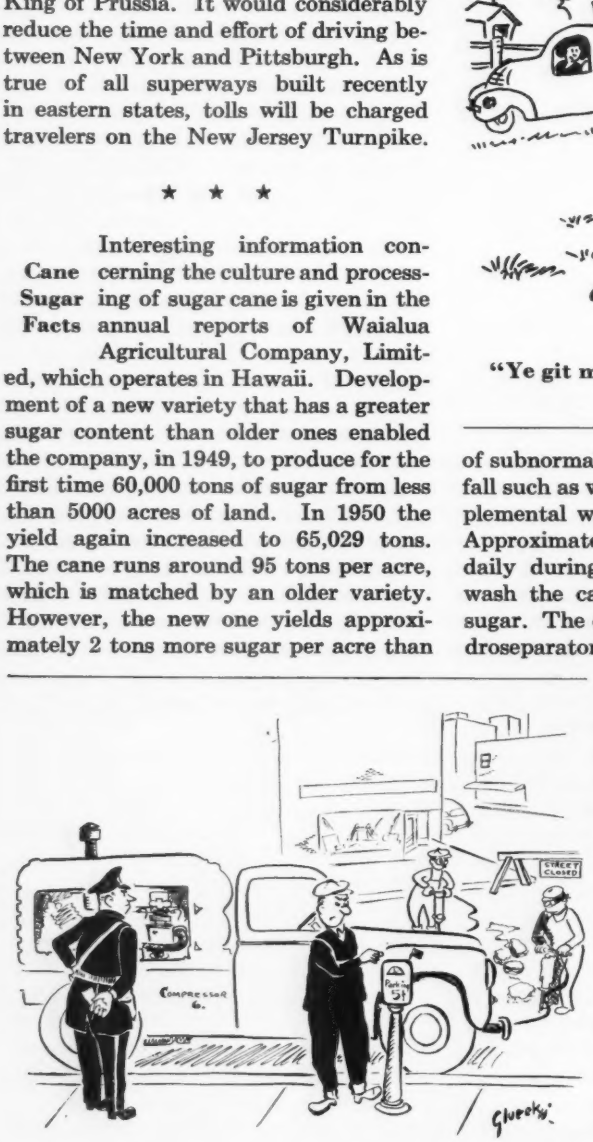
Cane requires about two years to mature. By means of a method developed by the company's agricultural advisor, Dr. Harry F. Clements, crops are now ripened under complete control. Periodical analyses of plant leaves indicate how much water and fertilizer the cane needs at that particular time, and it is treated accordingly. Temperatures during the growing and ripening periods also influence the time of maturity and the sugar content.

Water for irrigating the fields is mainly runoff from the mountains, but in times of subnormal or poorly distributed rainfall such as was experienced in 1949 supplemental water is pumped from wells. Approximately six million gallons is used daily during the processing season to wash the cane prior to extracting the sugar. The company has installed a hydroseparator that reclaims this water for irrigating purposes, and also recovers thousands of tons of adhering soil. This is placed on arable land where the topsoil is thin, and in 1949 enough of it was salvaged to cover 26 acres to a depth of one foot.

Cane will henceforth be transported from the fields by diesel-electric Tournahaulers instead of railroad cars. Eight of the new carriers, each with a capacity of 35 tons, replaces eight steam locomotives and 745 railroad cars. The change will involve the removal of 50 miles of tracks and the construction of 44 miles of roadways.

"I don't like it there. Try it over by the tree."

"Ye git more odd jobs workin' on a highway."



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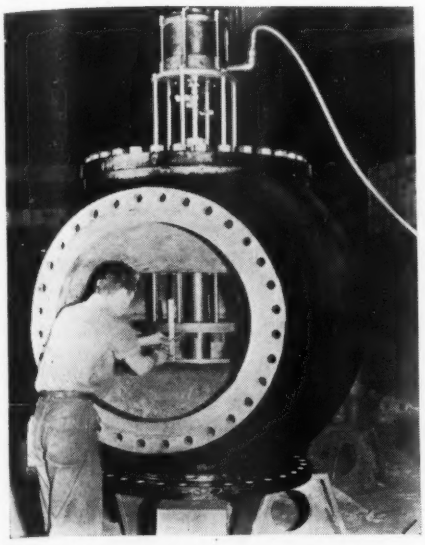
Kamloops To Cheer Anglers

The kamloops, a variety of rainbow trout that grows to an incredible size, is being transplanted from its native Canadian haunts to the lake behind Shasta Dam in California in an effort to give future American anglers some superlative sport. Jewell Lake, in British Columbia, yielded one kamloops with a verified weight of 52½ pounds and a length (not stated) probably between 3 and 4 feet. From a stream that feeds this lake, 2119 kamloops eggs were imported to a hatchery of the U.S. Fish and Wild Life Service at Battle Creek, Calif., in June, 1949, according to *The Reclamation Era*. A year later 1319 of them had matured into fish around 11 inches long, and these were planted in Shasta Lake. At the same time, 100,000 more eggs were procured, and these produced approximately 27,000 fry that were fed for a year and released in the lake this past May.

Anglers fishing for bass have caught several of the trout. The largest so far reported measured 22 inches, which would be considered a rather nice rainbow of any other type. Through the cooperation of fishermen, all that are taken now are reported and released. It is expected that they will be big enough to keep by 1956. To thrive, the kamloops must have plenty of suitable food and deep, consistently cold water. To insure adequate food, salmon eggs are also imported from Canada, hatched, and the young fish freed when they are around 75 days old. Approximately 400,000 of the eggs have been received up to date. During each of the next five years it is planned to stock 300,000 kamloops eggs and 600,000 salmon eggs. The venture has thus far been conducted by sportsmen organized as California Kamloops, Inc. Some money has been appropriated by local governments; the remainder comes from the pockets of fishermen.

Industrial Notes



What are believed to be the largest double-ported control valves in existence have recently been built by Kieley & Mueller, Inc., for a plant that is probably one of the world's biggest producers of oxygen. Despite their great size—their 36-inch pipe connection—they are constructed to precise specifications to insure absolutely tight shutoff and full movement from open to shut, or vice versa, within one second! The problem of guiding the plug was somewhat complicated because service requirements necessitated installing the valves on their sides. This was solved by equipping the guide posts with linear-type roller bearings that permit the plug to travel friction free. The valves are operated on a time-cycle basis by a pneumatic cylinder using air at 75 pounds pressure. They are designed for the purpose of controlling the regeneration process and are said to perform with entire satisfaction.

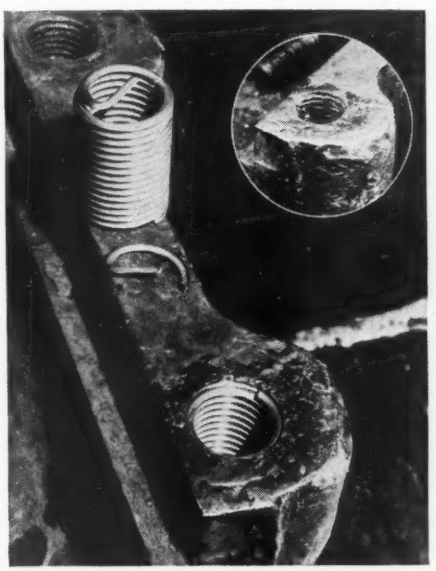
Gasket faces and pipe, bolt, and stud threads coated with Led-Plate will not seize, according to Armite Laboratories, maker of the compound. It serves both as a lubricant and sealer and can be used at temperatures from minus 350 to plus 2900°F. on steam, water, oil, ammonia, air, and other connections. Lead constitutes 70 percent of its metallic elements, which are held in suspension by hydrocarbons.

Difficulty in separating steel sheets in feeding presses is overcome, it is claimed, by the Magnetic Sheet Floater marketed by the Verson Allsteel Press Company. Standing alongside a stack, the device, which incorporates permanent Alnico magnets, induces a magnetic field that causes the ends of the sheets to float or fan out with a sufficient air space between adjacent ones so they can be picked up easily. The number of floaters required, their size, and position depend upon the weight, size, and shape of the work.

Sand in pipes is being compacted quickly by three pneumatic vibrators ingeniously mounted on a flat ring made in two sections and provided with lugs. When inserted in the latter, the vibrators rest on the ring. The assembly is suspended from the top of the pipe by wire ropes fastened to the lugs.

Experimental quantities of Santophen 45, a grade of sodium trichlorophenate for the control of slime formation in industrial cooling water, is being offered by the Monsanto Chemical Company, 1700 South Second Street, St. Louis 4, Mo. The product is especially suitable for cooling water that is maintained in acid condition and said to be highly effective against bacteria and algae.

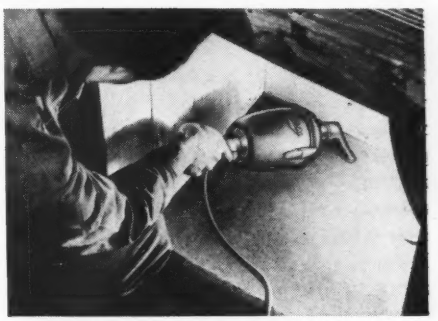
Stainless-steel thread inserts are expediting thread-repair operations on heavy electric-motor castings in a large shop, according to the Heli-Coil Corporation, manufacturer of the inserts. The work of replacement involves drilling out worn 1½x6 threads, retapping, and installing a Heli-Coil insert to bring the hole back to its former size. The coil has a notched inserting tang and is slightly larger in diameter than the receiving hole, making it self-locking. When in position below the surface of the casting the tang is broken off. Heli-Coil inserts are precision formed of diamond-shaped 18-8 steel wire, which gives them high thread-flank engagement. They are said to be stronger and more wear resistant than the original threads, are installed in 80 percent less time than conventional repair methods require, and effect cost savings of as much as 60 percent.



BEFORE AND AFTER REPAIR

This picture shows a Heli-Coil thread insert (top-left), a motor casting with worn threads (top-right), and the same casting with new threads in place in the drilled-out and retapped hole (bottom-center). The broken-off inserting tang is lying on the casting.

The vacuum cleaner illustrated is air-operated and designed for industrial use and primarily for work in areas where electricity would present a hazard. It is a handy tool for automobile service sta-



tions and for cleaning stock bins, dusty or linty machines, etc. The dirt-collector bag is inside the housing where it cannot soil upholstery and is easy to empty and clean. The unit uses air at a pressure of 70 to 160 psi., and at 100 psi. consumes 4½ cfm. It is a product of the Syntron Company and comes complete with a 12-foot-long hose.

Brown coal is being dug in open lignite mines near Helmstadt, Germany, by a huge blade-wheel excavator at the rate of 850 cubic yards an hour. The tractor-mounted machine is 240 feet long and 105 feet high and is driven by electric motors.

Two steel rules made to compensate for shrinkages of 1 1/32 inch and 1 3/32 inch per foot are being offered by L.S. Starrett Company to supplement its 1/12- and 7/16-inch shrink rules. They are available in 12- and 24-inch lengths, 1- and 1¼-inch widths, respectively, and are divided into 8ths, 16ths, 32nds, and 64ths.

Rulan is the name of a new plastic electrical insulation that will, it is said, not support combustion. A du Pont product, the material will not burn when the flame is removed and will not drip when molten. It can be injection molded and extruded on wire at high speeds.

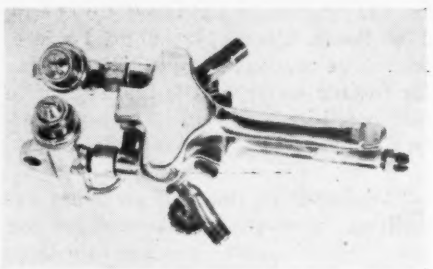
Lincoln Engineering Company, manufacturer of equipment for the application of lubricants, has added a new model to its line of transfer pumps. The Speed-

Flo, Model 82230, is air-operated and designed to handle thinners, coolants, naphthas, lubricants, noncorrosive chemicals, etc. Of sturdy steel construction, it fits all 2-inch-bung drums and has a built-in disk-type regulator that permits finger-tip control of the volume of output. The unit is said to pump fluids at the rate of 22 gallons a minute without spillage, emptying a 55-gallon drum containing S.A.E. 30 oil in a little more than a minute.

Compressed air solved the problem of an industrial concern when it decided to change from steam to purchased electric power and to use its boiler plant only for heating. Two steam hammers were involved, one of 800 pounds with an 18-inch stroke and a 2500 pounder with a 24-inch stroke. The question was, "How to operate them in warm weather?" The answer was simple. All that was required was to connect an air line of the same diameter as the steam line to the intake of each hammer and to interpose a check valve between the shutoff valve and the machine to prevent the accidental delivery of steam into the air line or vice versa. Now the hammers are run by air in summer with considerable worker comfort and by steam in winter and during emergencies.

Lignin, a waste product in papermaking, will increase the strength of natural and synthetic rubber. Half and half, says the West Virginia Pulp & Paper Company, will do the trick.

Liquids that are stable in themselves but cure quickly only when mixed with other solutions are being sprayed by a gun with two nozzles that has been developed by Schori Process Division of the Ferro-Co Corporation. Each has its own reservoir, and the fluids commingle after they issue from the nozzles—at the time



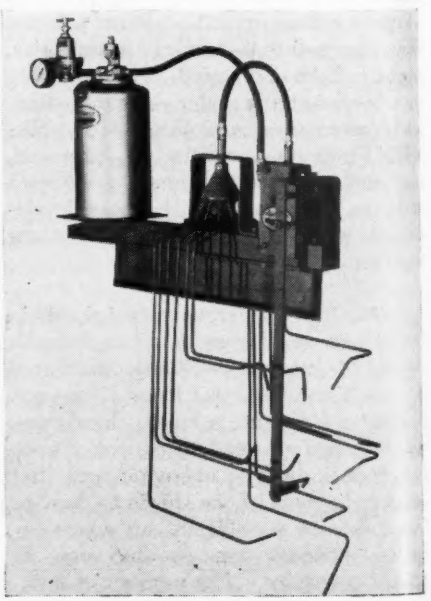
of atomization. In applying Marco polyester resins, for example, the material is equally divided: one-half mixed with Marco catalyst goes in one pot and the other half, containing an accelerator, in the other. The resin-catalyst blend remains stable for at least one working day and the resin-accelerator blend for a considerably longer period. The result, says the concern, is rapid gelation—about three minutes at 70°F. The procedure permits the use of a relatively large quantity of accelerator and compounds which, if put together in a single reservoir, would set before they could be sprayed. The gun, Model 2S, is of the pneumatic type and uses air at 70 psi., line pressure. A compressor that delivers at least 15 cfm. is recommended for the purpose.

Spo, Inc., has announced an addition to its line of pneumatic vibrators under the designation Series 79. The new units are available in eight

standard sizes with 2- or 2½-inch pistons and with a long or standard stroke. All are tapped ¼ inch for rigid, swivel, straight, or ell-type hose connections and use air at 80 psi., line pressure. They are recommended for service in connection with hoppers, chutes, tables, and concrete-block and other production machines designed for intermittent or continuous operation. In combination with Spo quick-acting valves in the case of hopper installations, the vibrators function only when the hopper discharge gates are open, thus conserving air power and preventing accidental packing of material through premature operation.

Applying a protective layer of Neoprene by brush or spray gun to steel, concrete, and wood makes them resistant to oil, grease, many chemicals, and the action of the weather, it is claimed. The new coating is a product of Gates Engineering Company.

The lubricator shown here was especially designed by J.N. Fauver Company Inc., for a builder of automobile bodies and is installed on one of the latest types of power conveyors that carries the parts through wash and paint booths. Oper-



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SQUARE D COMPANY
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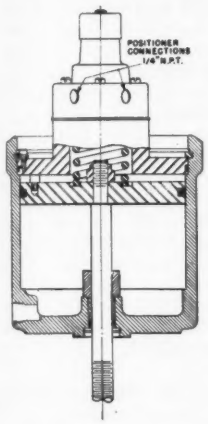
ated by compressed air, it automatically delivers controlled amounts of oil simultaneously to twelve critical points of wear on the conveyor that were formerly lubricated by hand. It is equipped with a reservoir that holds 2 gallons, or a two weeks' supply, an air regulator and pressure gauge, and the necessary manifold pipe connections and nozzles.

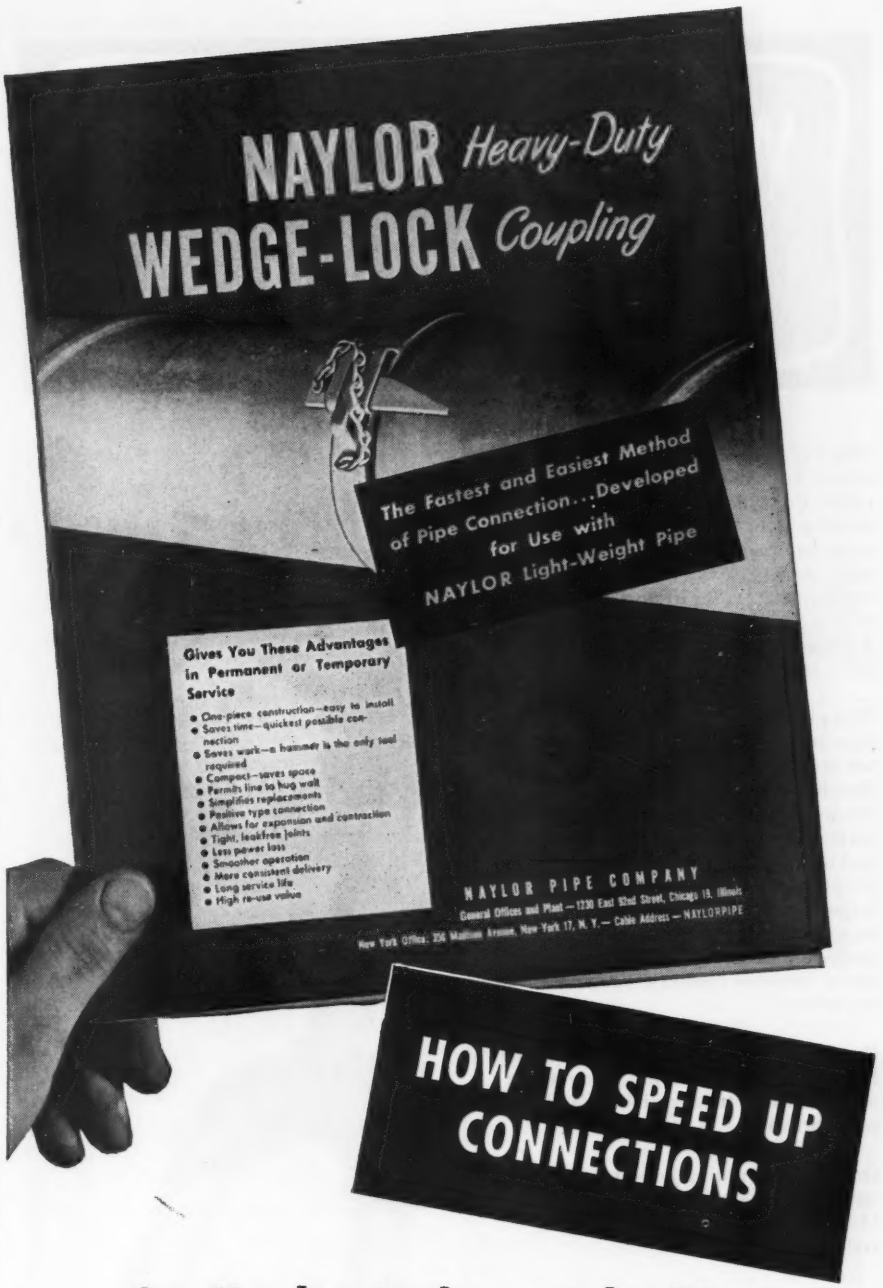
Six years ago, Pennsylvania enacted a bill for the conservation of lands denuded by bituminous strip mining. Since that time more than 10,000,000 trees and shrubs have been planted by the operators.

For throttling control service, Conoflow Corporation is offering a new line of pneumatic cylinders of the bucket type. The Series B-50 has a piston positioner that is mounted integrally on the head plate and controlled by a contact spring that rides on the piston. "O" rings are used to seal the head plate, piston stem, and piston, that for the latter being graphite-impregnated to insure tightness with a minimum of friction. The cylinder itself is of aluminum and is machined, honed, and polished to provide a smooth and concentric bore. The units are designed for use with air at pressures up to 100 psig. and are said to reposition the piston with an accuracy of 1/500th part of the total travel. They are available in 4-, 6-, and 8-inch bores.



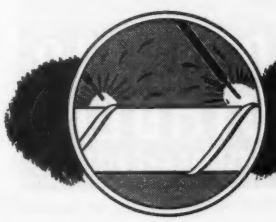
Dry ice is serving the rubber industry by removing fins from molded rubber parts. Placed together in a tumbling barrel, the ice freezes the projections and makes them brittle. In that condition they break off as the drum rotates.

For those who must have a thermometer always within reach, the Thermicator might be a handy tool. It is a pocket-size instrument that has an adjustable clip and a pinch top which projects from and by which it is pulled out of its protective case, in which it is held firmly by spring pressure. In its case and suspended from a cord it serves as an armored thermometer, but for general temperature testing, where there is no danger of breakage, it is removed from its housing. The Thermicator can be used for registering temperatures between minus 30° and plus 120°F. It is 6 inches long and ⅜ inch in diameter and made by Tagliabue Instruments Division, Weston Electrical Instrument Corporation.


NAYLOR Heavy-Duty
WEDGE-LOCK Coupling
The Fastest and Easiest Method of Pipe Connection...Developed for Use with NAYLOR Light-Weight Pipe
Gives You These Advantages in Permanent or Temporary Service
NAYLOR PIPE COMPANY
HOW TO SPEED UP CONNECTIONS

...On Naylor Light-weight Pipe In Heavy-duty Service

This new bulletin, No. 513, presents complete facts on Naylor's Heavy-Duty Wedge-Lock Coupling—the fastest and easiest method of pipe connection yet devised for light-weight pipe from 8″ to 30″ in diameter. Write for your copy today, without obligation.



NAYLOR PIPE COMPANY
1245 East 92nd Street, Chicago 19, Illinois
New York Office: 350 Madison Avenue, New York 17, N. Y.

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The Victaulic name stands for pioneering and world leadership in quick, dependable piping construction. Victaulic offers a *complete method* of piping that just can't be beat! From one end of the line to the other . . . for almost every kind of piping job . . . you'll find that Victaulic's the EASIEST WAY TO MAKE ENDS MEET!

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Preparing pipe ends is a cinch with the "Vic" Method . . ."Vic-Groover" grooves 'em automatically, twice as fast as a conventional pipe threader!

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27TH VICTAULIC YEAR

The easiest way to make ends meet
VICTAULIC
PIPE COUPLINGS AND FITTINGS

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Books and Industrial Literature

A liberal education concerning the substances that make up the principal commerce of the world is contained in *Materials Handbook*. Termed "An encyclopedia for purchasing agents, engineers, executives, and foremen," it is all that and more. It gives practical data on some 9000 materials ranging from abrasives to zirconium, using nontechnical language that is understandable to everyone. Included are both natural and manufactured products, trade-named and patented materials—in short, just about everything that is used to an appreciable extent in industry.

A separate section gives basic information on the occurrences of natural materials, on weights, measurements, physical comparisons, etc., and even contains an elementary discussion of nuclear physics.

The current edition is the seventh, and a brief examination of the volume reveals why it remains in demand. The original work appeared in 1929 and was compiled because the author, George S. Brady, had need of a quick reference to basic information on all kinds of industrial materials when he was an American Trade Commissioner in South America. With each succeeding edition Mr. Brady has sifted his facts with the idea of including only those of practical import, and of adding those needed to bring the book up to date. As it stands, it could easily be the most valuable reference work a purchasing agent or executive could have on his desk.

Materials Handbook, 864 pages and index, is published by McGraw-Hill Book Company, Inc., 330 W. 42nd Street, New York 18, N. Y. Price, $8.50.

Publication GEA-5588, distributed by General Electric Company, Schenectady, 5 N.Y., gives essential data on adjustable-speed drives for calendering rubber, plastics, and similar materials.

Wheelco Instruments Company, 847 W. Harrison Street, Chicago 7, Ill., has a new bulletin describing its Capacitrol, an instrument for measuring and automatically controlling temperatures of any type of heating equipment.

Latex-insulated telephone cables are discussed in a booklet obtainable from United States Rubber Company, Rockefeller Center, New York, N.Y. A section is devoted to a new cable-splice housing that eliminates hand taping.

On the site of the original Thomson-Houston Laboratory in Lynn, Mass., General Electric Company has erected a $2,000,000 laboratory that is equipped to solve well-nigh every measuring problem. Its facilities are described in a booklet, GED-1406, obtainable from the company at Schenectady 5, N. Y.

Surge Control in Gas and Air Piping is the title of a bulletin issued by Burgess-Manning Company, manufacturer of snubbers for these lines. It is explained that surging due to the pulsating flow of compressible fluids in pipes is not an acoustical problem but one of dynamics. The publication is obtainable from the company's office at 1203 Dragon Street, Dallas, Texas.

Standards for pneumatic equipment recently adopted by the Joint Industry Conference on Pneumatics have been published for free distribution by Miller Motor Com-

pany, manufacturer of pneumatic and hydraulic cylinders and related products. Designated as the *J.I.C. Pneumatic Standards*, copies may be obtained from the company at 4027 N. Kedzie Avenue, Chicago 18, Ill.

A new bulletin by Allis Chalmers, 1000 S. 70th Street, Milwaukee, Wis., describes types of construction and ratings of totally enclosed, fan-cooled motors in which the air that carries the heat away is conveyed to a nest of tubes surrounding the stator and then expelled by air blown in from the outside by a fan. The motors can be modified into explosion-proof types. The bulletin is designated as 05B7150A.

The story of industrial accidents and how to prevent them is told in a booklet obtainable from the National Safety Council, 425 N. Michigan Avenue, Chicago 11, Ill. It concerns itself primarily with suggestions for bringing about greater safety in small plants, which lag behind larger ones in this respect. Titled *Safety Pays the Smaller Business*, the publication is being widely distributed by insurance companies.

The pneumatic screw driver is a mighty tool to judge by a broadside, Form 5056, being distributed by Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y. It presents case histories showing where users saved up to $15,500 a year by adopting them. One equipment manufacturer bought 46 in one lot and figured they paid for themselves in ten days. The broadside also illustrates and describes the construction of the screw driver in detail.

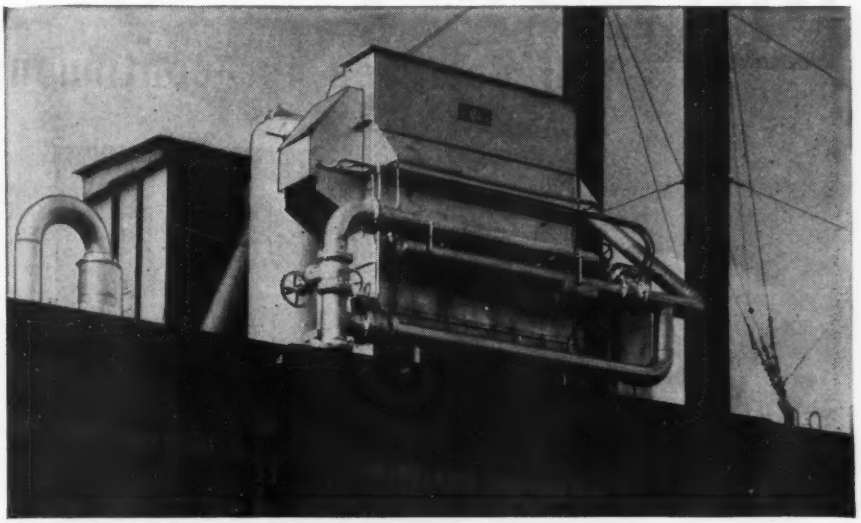
Catalogue B-4761 issued by Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa., enumerates 72 sound motion pictures available upon payment of the shipping charges to organized groups such as church, social, professional, civic, and business societies and clubs. The films cover general-interest subjects, product information, and training and instruction courses, and under each title is a list of the kind of people that should be interested in a particular picture.

Naylor Pipe Company offers an illustrated bulletin describing its heavy-duty, "Wedge-lock" coupling for use with its Spiralweld pipe. The coupling can be applied or removed quickly with the aid of only a hammer and is suitable for either permanent or temporary service. It is available for pipe lines ranging from 8 to 30 inches in diameter. The bulletin may be had from the company at 1230 East 92nd Street, Chicago 19, Ill.

A new bulletin describes Electric Machinery Manufacturing Company's line of "packaged" generators that deliver electric power at constant voltage without accessory switchboard equipment. The 16-page booklet explains the machines in detail and contains electrical information, charts, graphs, and illustrations to aid in selecting and applying them. Titled *The ABC of Packaged Generators*, copies may be had from the company at Minneapolis 13, Minn.

The inception and growth of the second largest source of aluminum in the nation is outlined in a 48-page booklet produced by Reynolds Metals Company, 2500 South Third Street, Louisville, Ky. It gives details about the company's manufacturing facilities, products, fields of applications, etc. The output of aluminum from bauxite, the characteristics of the metal, the many forms in which it is available, and the varied ways they serve mankind are all covered. More than 250 illustrations are included.

Direct saving of cooling water expense returns to you the cost of a Niagara Aero After Cooler in less than two years.



How to Get Drier Compressed Air:

It prevents many troubles and saves much expense

● NIAGARA AERO AFTER COOLER cools compressed air or gas below the temperature of the surrounding atmosphere. Therefore you get no further condensation in your lines. You save much in repairs to pneumatic tools and equipment; you save much interruption to production; you save water damage in paint spraying, in air cleaning, in any process where compressed air comes in contact with your materials or parts in manufacturing (sand blasting, for example).

Niagara Aero After Cooler uses evaporative cooling, saving 95% of your cooling water consumption. This saving quickly returns the cost of the equipment to the owner or makes extra cooling water available for other processes.

The Niagara Aero After Cooler produces compressed air with 30% to 50% less moisture than by ordinary cooling methods. Other Niagara equipment provides bone-dry air for processes requiring it.

If you have an air problem or a cooling problem, a Niagara engineer probably has an answer that will improve your process or save you operating or maintenance expense.

Write for Bulletin 98

NIAGARA BLOWER COMPANY

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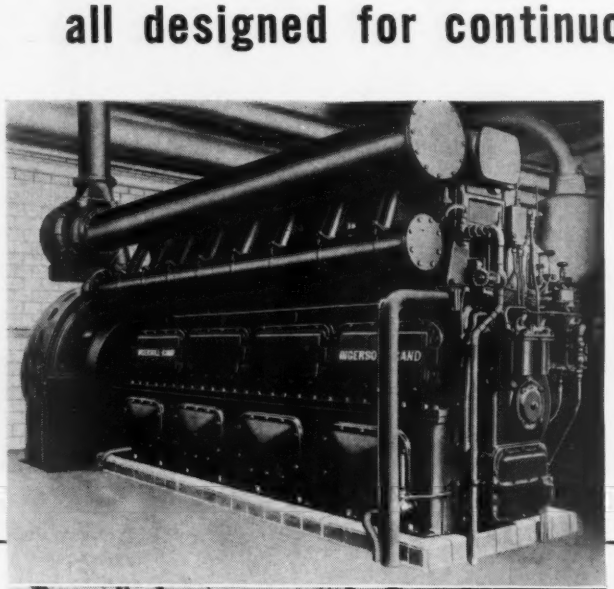
Experienced District Engineers in all Principal Cities

Heavy-Duty Diesels . . .

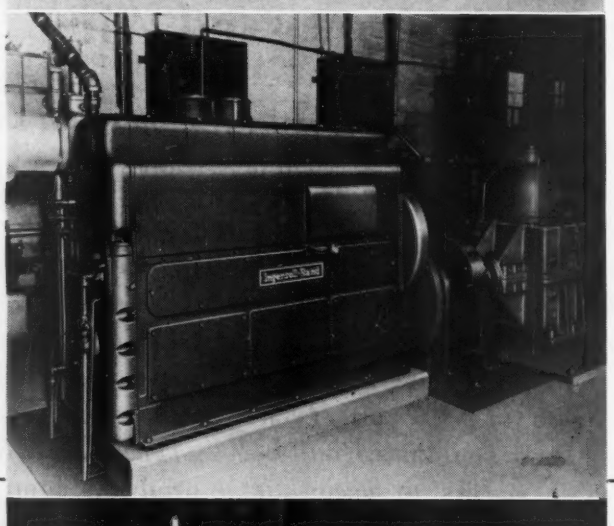
all designed for continuous full-load operation



An I-R 8 cylinder SS Diesel Engine driving a 600 kw generator in a factory.

The I-R type "S" is a 4-cycle, heavy-duty, medium-speed diesel engine with a fuel consumption of only 0.38 lbs per bhp-hr at full load. It has a bore of 10½ inches and a stroke of 12 inches. Speed is 720 rpm for driving 60-cycle generators and 750 rpm for 50-cycle and mechanical drive. It is available with 6, 7, or 8 in-line cylinders and rated at 450, 525 and 600 hp.

The type "SS" is a turbo-charged "S" and provides maximum economy of space and weight by producing more than 50 percent more power than unsupercharged engines. Available in 6, 7, and 8 sizes for 710, 825, and 945 hp.

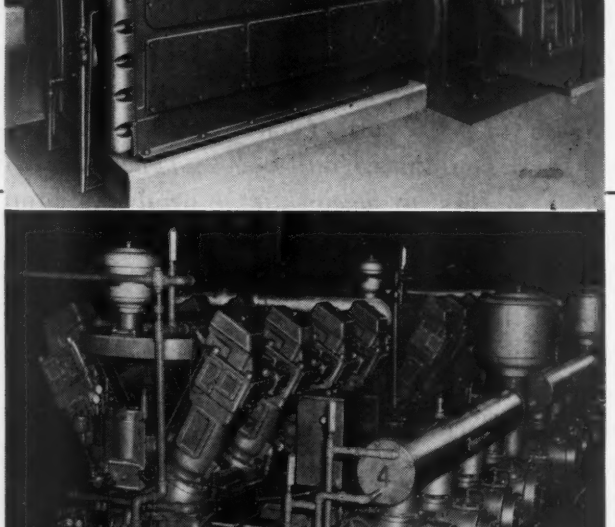


An Ingersoll-Rand 6 cylinder TS Diesel Engine driving an I-R vertical water pump through right-angle gears at a paper mill.

Ingersoll-Rand's new TS diesel engine is a smaller, lighter-weight engine built with all the longlife features, stamina and dependability of big engine design. It is 7 inch bore, 8½ inch stroke diesel with a fuel consumption of only 0.40 lbs per bhp-hr, but weighs about 30 lbs per hp.

Features include: big 5¼" crankshaft, full-floating aluminum-alloy bearings—full pressure lubrication, individual cylinder heads, replaceable liners, removable valve-seat inserts, large single-hole injection nozzles, gear-driven supercharger and many others.

Available with 6 or 8 in-line cylinders and delivering 200 to 375 continuous hp at 900-1000 rpm.



An I-R XVO Diesel-engine-driven air compressor with 8 power cylinders and 4 compressor cylinders on a construction project.

When a Diesel-powered compressor is needed, the Ingersoll-Rand "XVO" is the perfect answer; it combines a heavy-duty 4-cycle diesel engine and a heavy-duty, double-acting compressor in a single, compact machine that's easy to install and relocate. It assures a maximum compressed air output per pound of fuel. With one gallon of fuel oil, the XVO compresses 5600 cu ft of air to 100 lb pressure.

The XVO is available with compressor cylinders for any pressure or vacuum in four sizes with 2, 4, 6, or 8 diesel power cylinders rated at 66 to 280 hp.

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